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The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

Vol. XXIV. No. 7.

JULY, 1927

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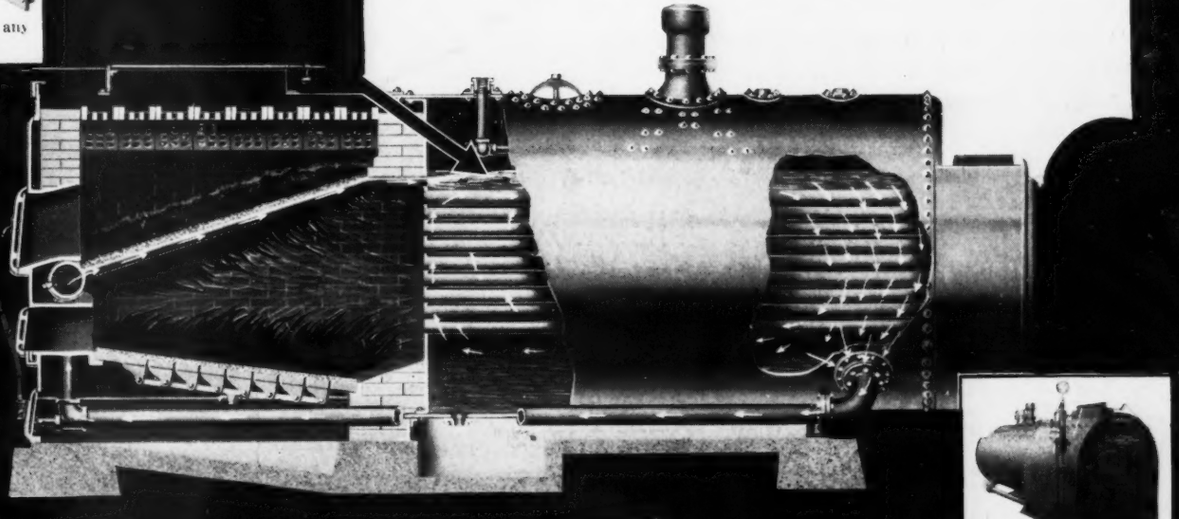

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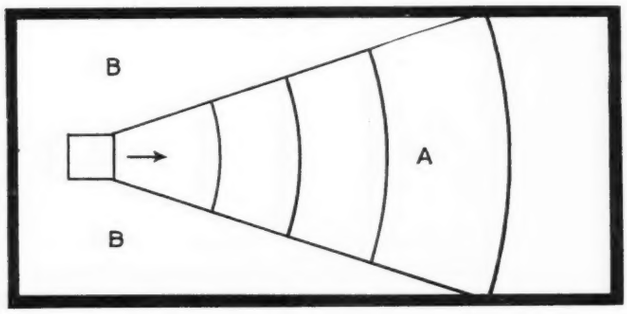
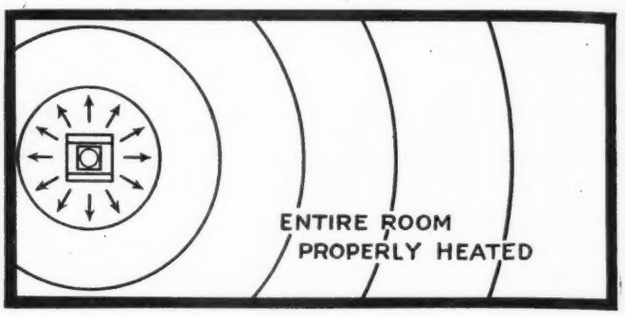


DIAGRAM 1

If heat is delivered in only one direction, section A in direct path of heat travel, but section B outside zone of direct heating.



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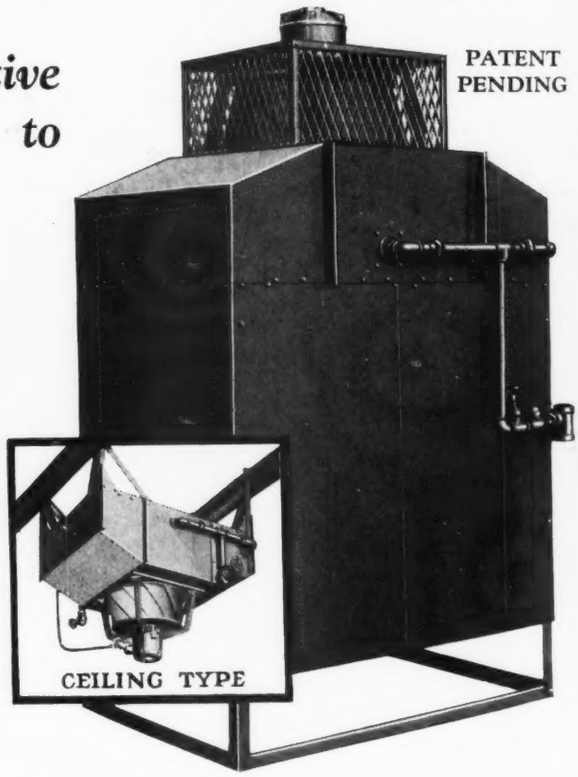

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The Heating and Ventilating Magazine

VOL. XXIV

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No. 7

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YEARLY SUBSCRIPTION $2.00 SINGLE COPIES, 30 CENTS

Published monthly at 1123 Broadway, New York, by the Heating and Ventilating Magazine Co.

Entered as second-class matter, April 18, 1925, at the Post-Office at New York, N. Y., under the Act of March 3, 1879.

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The Progress of Heating and the Prevention of Heat Waste

Fifth of a Series

Parts of World Remain Antiquated

THE peasant countries of Europe, and neighboring parts of our own continent, continue relying on the antiquated fireplace for heat. It remains the family's hugged center of the home. For those folks modern advancement holds nothing. They endure their discomforts and allow their heat and fuel to dissipate uncorrected.

Here in America modern heating means and methods are enjoyed by all of us. So perfected is our heating that we give little or no care and attention to its source and cause and consequences.

Here in America, with fuel costs 115 per cent higher than only a few years back, heat and heating apparatus are controlled by the Johnson System Of Heat Control. Each room of buildings is individually maintained at its proper and required temperature. at the same time effecting a fuel economy amounting to as much as 40 per cent per year.

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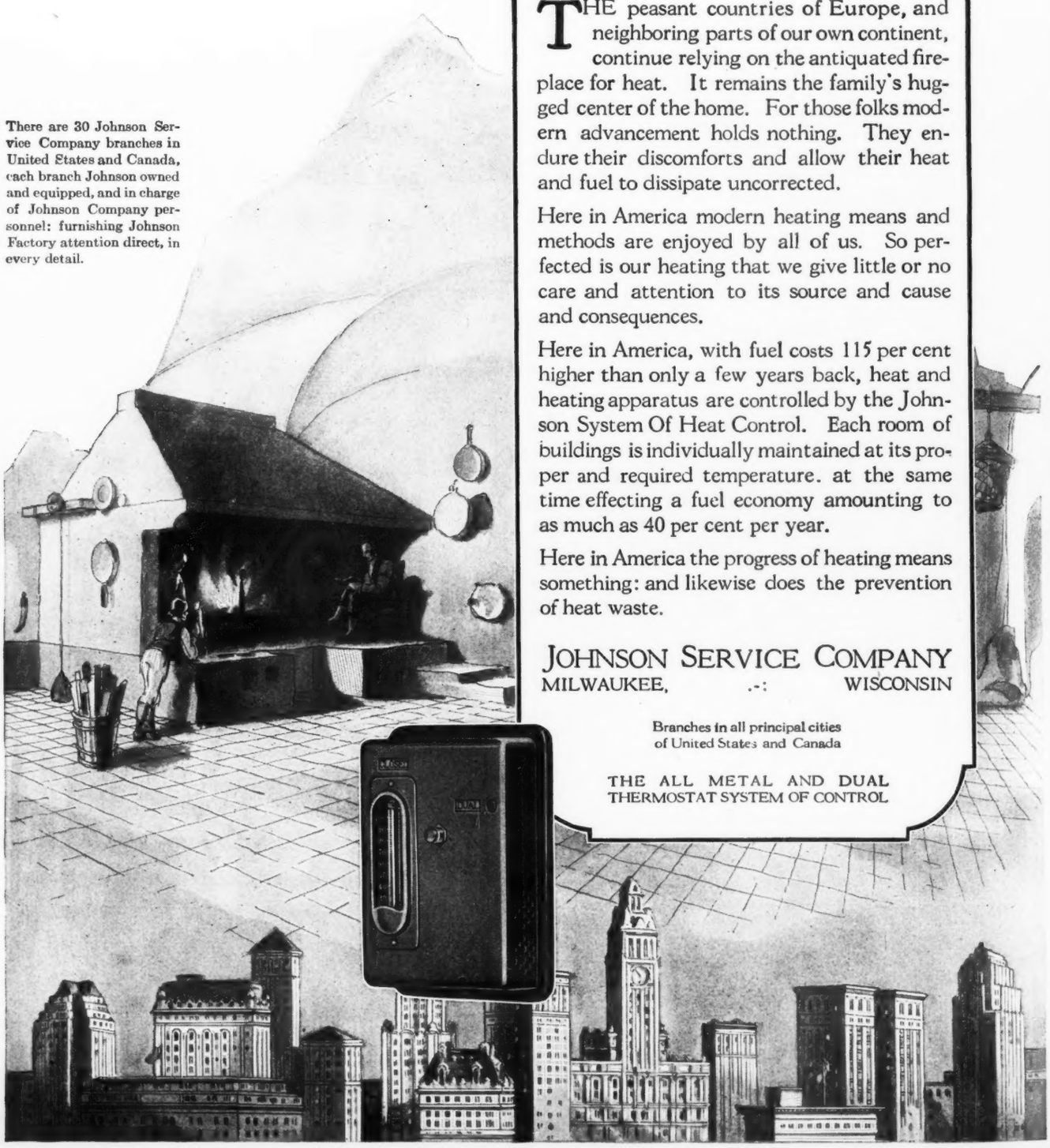

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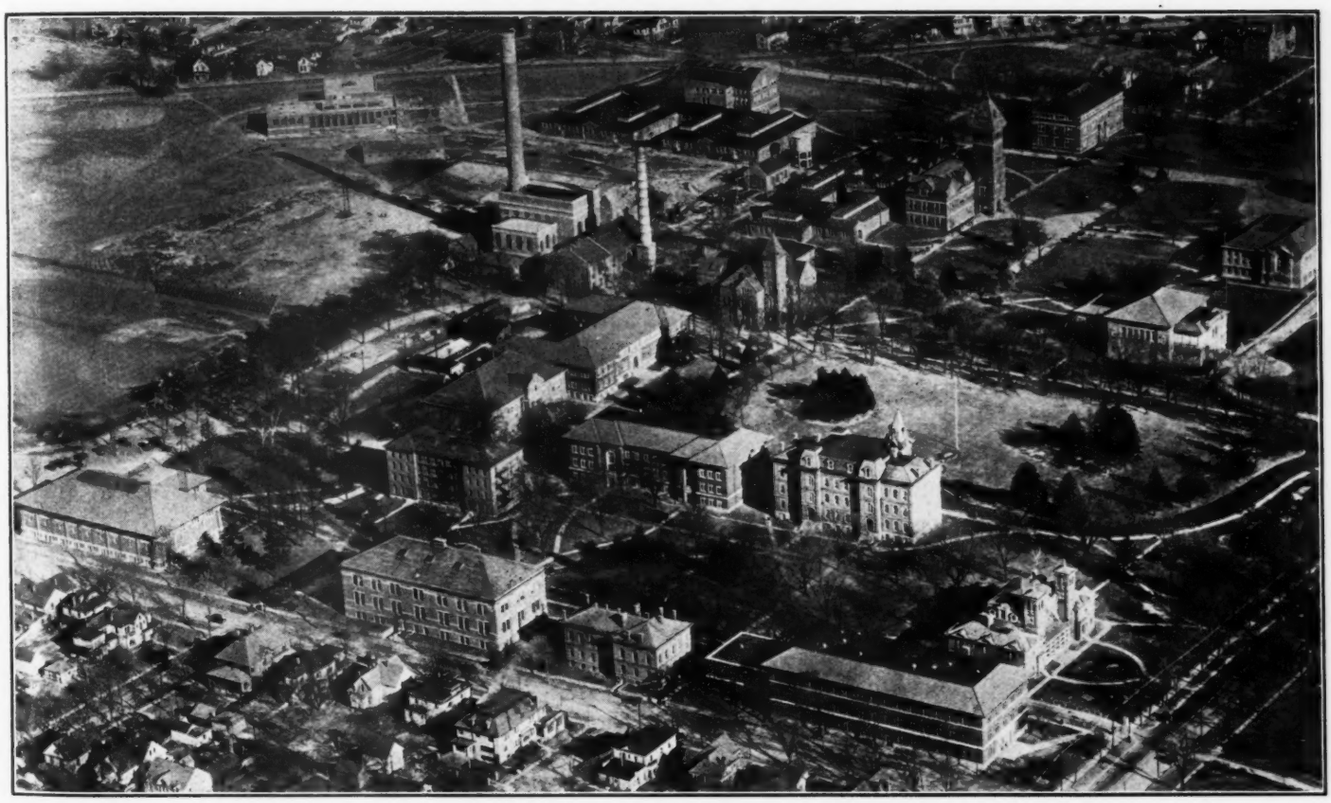


Bird's-Eye View of Campus, Purdue University

Purdue's New Central Heating Plant

Details of a Steam Heating and Power Distributing System Covering 1000 Acres with a Radiation Load of 700,000 Sq. Ft.

By J. D. Hoffman

Head of the Department of Practical Mechanics, Purdue University

SINCE the early days of Purdue University, when it numbered less than a half-dozen buildings, two of which were dormitories, steam mains between buildings have not been run according to any definite plan, but had to be developed by mere force of circumstances. As is true of most educational institutions in their more formative period, future needs were difficult to visualize, and if, perchance, a seer were available, finance was decidedly lacking. As a result, there are now nearly three dozen buildings on this campus, joined by a net-work of pipes carrying steam at varying pressures and enclosed in conduits of various types of construction.

The earlier conduits were very crude pump-log affairs and those of more recent years are, in the

NOTE: This article is based on a similar, but briefer, paper presented by Professor Hoffman at the annual meeting of the National District Heating Association, West Baden, Ind., May 17-20, 1927.

main, of local design and construction, having brick sides, half tile tops, through-rods with pipes over the rods as rollers, gravel bottoms for drainage, mains insulated with sectional covering, suitable anchorages, and long radius bends at ninety degree corners as expansion take-ups. All pipes were graded for gravity drainage but, as additional buildings were added to the lines, vacuum pumps had to be attached to the returns to avoid water logging and flow pressures had to be increased on the supply lines. The whole system has proven to be a most faithful, if not efficient, servant and, after nearly fifty years of service, is about to be retired.

The institution has now reached a stage in its career where economic expenditure for future growth demands that all development shall be according to a pre-arranged plan. In accordance with this idea, and with the assistance of specific grants of money by the last two legislatures, an especially-appointed commission approved a campus plan covering the possible growth over a period of years, and engineering committees, after several years of deliberation, have approved general and detailed plans for campus utilities. This article refers to one part of that general plan.

CAMPUS PLAN

Fig. 1 shows the present buildings (plain) with their installed radiation (equivalent direct) and the proposed buildings (single cross-hatched) with their assumed equivalent direct radiation. The connecting lines show the proposed underground distributing system. This new distributing system does not follow the old conduit lines except in a few short runs. The lower section of this, from A 8 to A 30, is now in.

State Street, the principal east and west thoroughfare of West Lafayette, divides the campus into two not very unequal sections. The south campus is devoted to agricultural activities and the north campus to science and engineering. The first half, only, of the proposed new power plant, 13, has been put in, consequently the old power plant, P, is retained for the present as a stand-by.

In the proposed plan, quadrangle groupings will be followed as far as possible and some of the older buildings such as six and seven will be either removed or remodeled to conform to the general plan.

Railroad facilities are obtained over the Big Four, Nickel Plate, running from east to west, 2680 ft. south of State Street, and a spur leading up to the power plant. Fuel and building supplies therefore, are brought to the center of distribution.

THE PROBLEMS TO BE SOLVED

This study of the campus utilities was begun in 1923-24, and, touching as it did every campus service—steam, electric, hydraulic, etc.—has resulted in a composite design which represents the co-operative thought of all departments. In the order following, the study comprised:

(1) Location of power plant relative to railroad. This touched upon (a) transportation of fuel and supplies, (b) distribution of steam for heating and power—whether live or exhaust, high or low pressure, (c) distribution of electricity for power and light, (d) distribution of water, gas, signal, and other campus service.

(2) Design of the power plant, selecting equipment and locating same.

(3) Routing steam lines for heat and power distributing systems.

(4) Specifying underground piping systems, giving sizes, fittings and accessories.

(5) Selecting housing (conduit or tunnel) for distributing system.

(6) Designing underground housing system, pipe supports, anchorages, expansion take-ups, etc.

In this paper, reference will be made chiefly to those factors touching the design of the underground system.

LOCATION OF POWER PLANT

The first thing to be settled was the location of the power plant. Two locations were considered; south where line A B, Fig. 2, crosses the Big Four, Nickel Plate Railroad, and at (13) next to the old power plant.

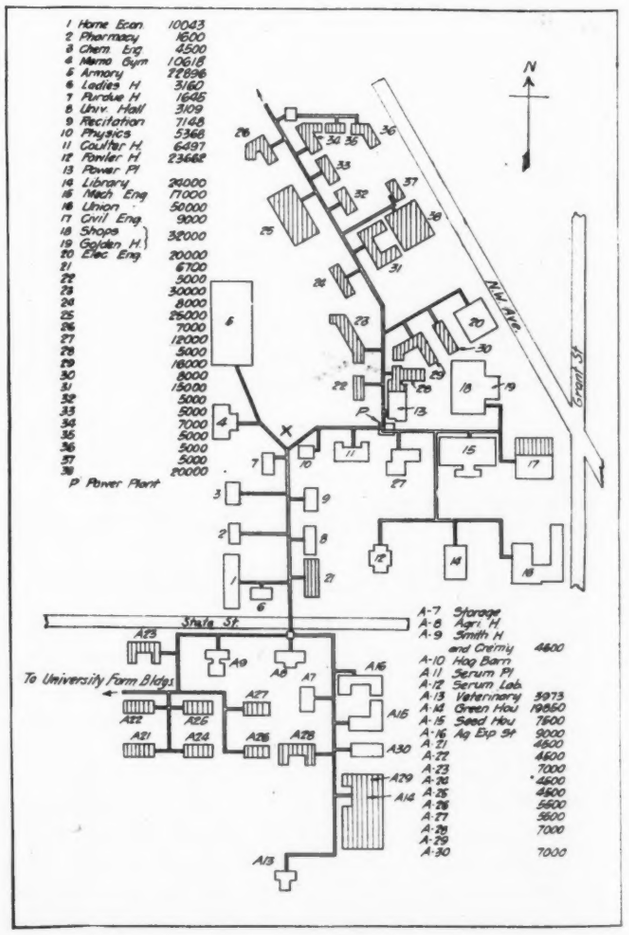


Fig. 1. Layout of Steam Distribution System at Purdue University

The Buildings Shown Cross-Hatched are Perspective. The Plain Outlines Show Existing Buildings.

The advantages for the railroad location were:

(a) easy access to transportation, fuel, supplies, etc.,

(b) avoidance of traffic noises, smoke, dust, etc., around the university buildings during session hours.

The advantages for location (13) were:

(a) Indications point to a rapid development in the direction of D E F, Fig. 2. This line will eventually supply the Ross-Ade Bowl and the section reserved for men's dormitories. This location would, therefore, place the plant in a fairly central position for supplying all campus service, power, heat, light, water, telephone and signal systems. This service includes also high pressure steam to various laboratories over the campus and especially to laboratories (15) Fig. 1, for steam-power experimentation.

(b) Buildings may be more satisfactorily grouped, thus aiding distribution in steam supply and condensation return.

(c) Exhaust steam from the power plant is an important factor in this institution and this would be available for heat in one or more nearby groups. Section A G H I K is the oldest and most congested part of the campus and this will probably continue, as in the past, to utilize most of the exhaust steam, with live steam auxiliary.

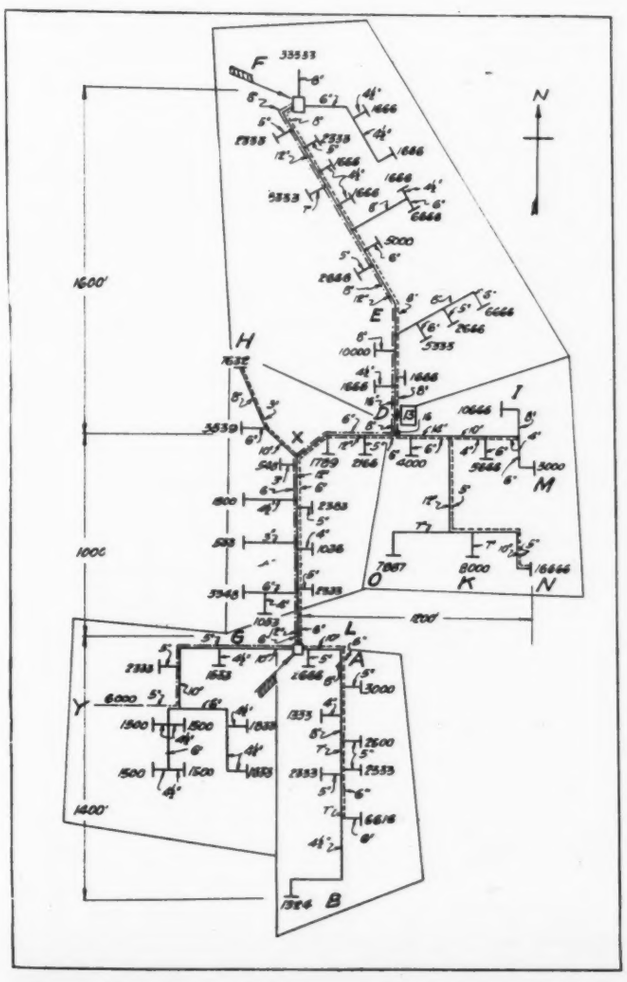


Fig. 2. Pipe Sizes and Maximum Hourly Steam Demand of Purdue University's Central Heating System

(d) Individual high-pressure lines may be run to outlying distribution centers, such as F and L, and from these points low-pressure distribution may be had through small groups as on the present campus.

(e) By group distribution, pipes would be relatively smaller, breakdown liabilities would be less, and if breakdowns should occur, the tie-up would be limited to a smaller area.

(f) Distribution of electricity, air and other campus utilities would be simplified.

(g) The smoke nuisance, which is usually a serious problem, would be overcome by improved furnace auxiliaries and a high stack. (This has now been installed, 250 ft. high.)

(h) Shipping noises *are* a serious objection in those buildings along the spur, but this is being reduced as much as possible by shipping during other than class hours, and eventually this line may be electrified.

All points considered, the centralized location at (13) was selected.

DESIGN OF THE POWER PLANT

All parts of the generating and distributing systems were co-ordinated and the designs were brought to a practically completed state before the power plant was begun. About one-half of this is now in service at (13) with the old plant (P) serving largely as a stand-by unit. When (13) is completed (P) will be removed.

Although the power plant may be considered a matter for separate discussion, certain associated facts are of interest.

The completed plant contemplates eight 500 H.P. Stirling boilers, class XIII, each boiler having 5005 sq. ft. of heating surface; steam pressure 200 lbs. gage; boilers to generate at 200% of rated capacity; three boilers equipped with Foster superheaters (100° super-heat) for generating and for auxiliary units.

Four batteries of two independent boiler settings, are arranged with a 2-in. air space between settings. Underfeed stokers are used. Ratio of heating surface to grate surface is 60.5 to 1. The combustion chamber has a volume of 2110 cu. ft. per boiler, giving a ratio of heating surface to combustion space of approximately 2.4 to 1. Air for combustion is supplied to stokers at a pressure of 7 in. of water. Raw water for boiler feed is treated in a hot-process water-treating plant. Two 4000 H.P. metering open feed-water heaters are used. Water is fed to the boilers at 220° F.

The chimney flue is 15 ft. by 250 ft. Coal is dropped from hopper-bottom cars to a double-track hopper, then crushed, elevated and distributed to overhead steel suspension-type coal bunkers having a capacity of 275 tons. Coal is distributed from these bunkers to stokers by a one-ton motor-operated weighing lorry, giving opportunity to keep accurate account of coal delivered to each stoker. Coal storage eventually will be in a concrete pit

(*Continued on Page* 79)

The Chemistry of Oil Combustion

Present-Day Theory Identifies Gasified Hydrocarbons as an Elementary Fuel

By P. E. Fansler

Associate Editor, THE HEATING AND VENTILATING MAGAZINE

Part II

A SUBJECT of no small importance to the oil-burner engineer is the velocity with which flame travels through flammable mixtures and the factors that enter into this problem of rate of flame propagation. As with many other phases of scientific and engineering research, it is found that data derived from precise laboratory experiments do not invariably check with practical operation. The savants who have contributed what little is known on this subject, Mallard, Le Chatelier, Mason, Wheeler, Parker, Payman and others, have attempted to formulate laws governing the rate of flame propagation, but the subject is so complex, and so replete with apparent contradictions, that it is difficult to derive specific application of their data to the combustion of gaseous hydrocarbons as burned in a heating boiler.

Some fascinating experiments by Payman produced curves showing the variation in flame speed when methane (CH_4) was burned with varying proportions of oxygen available. Four series of experiments were made, the first with (the oxygen in the) air as an oxidizing agent; the second with a mixture of 50% oxygen and 50% nitrogen; the third with 66% oxygen and 34% nitrogen, and the fourth with 100% oxygen. The derived ordinates are plotted in terms of flame velocity in cm. per second.

Considering the curve where the combustion agent was 66% oxygen, it is seen that with less than about 10% CH_4 the mixture was so "thin" that combustion could not travel through it—the velocity was zero. Increasing the proportion of gas-to-oxygen increased the velocity of flame propagation until a high point was reached (about 30 volumes of gas to 100 of oxygen) and the rate then decreased, following a declining curve similar to that of increase. When the richness of the mixture reached about 45 volumes of gas to 100 volumes of oxygen, there was so little oxygen in the mixture that, again, combustion could not be propagated from layer to layer and the velocity consequently became zero.

The result of increasing the richness of the oxidizing agent is very evident from the four curves. When the gas was burned in pure oxygen the maximum velocity reached 5,500 cm. per second—more than 50 times the greatest velocity in air.

Another valuable experiment carried out by Payman was a determination of the flame speeds of three hydrocarbon gases.

This specifically applies to our problem of burning oil fuel, and the curves tell an interesting story. All of the experiments were made with air as the oxidizing agent, the abscissae being in per cent of combustible gas to air.

It can be seen that, regardless of the particular gas used, the minimum speeds for lower and upper limits of concentration are almost the same—approximately 20 cm. per second. Moreover the

PROPAGATION OF FLAME IN MIXTURES OF VARIOUS GASES AND AIR.

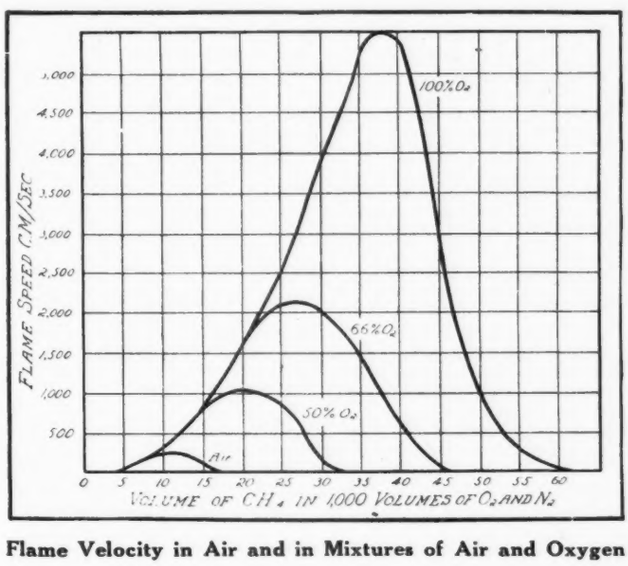
Gas	Lower Limit		Maximum Flame Speed		Upper Limit	
	Gas Percent.	Flame Speed (cm. sec.)	Gas Percent.	Flame Speed (cm. sec.)	Gas Percent.	Flame Speed (cm. sec.)
CH_4	5.80	23.3	9.52	66.6	13.35	19.1
C_2H_6	3.30	18.1	6.53	85.6	10.60	19.7
C_3H_8	2.37	20.8	4.71	82.1	7.30	20.3
C_4H_{10}	1.95	20.1	3.66	82.6	6.53	20.3
C_5H_{12}	1.61	20.2	2.92	83.0	5.40	20.2
H_2	6.19	10.0	36.3	503.0	71.39	50.0
CH_4+H_2	6.03	15.0	14.93	135.3	20.80	24.3
CO	16.29	19.5	44.84	60.1	71.19	19.4
CH_4+CO	9.45	21.9	15.95	91.3	21.55	19.8
CO H_2	9.25	18.2	45.92	315.2	71.34	44.4
C_2H_2	3.45	41.0	8.9	282.0	16.00	68.0

maximum speeds of C_2H_6 (ethane) and C_5H_{12} (pentane) are almost the same, approximately 82 cm. per second, with that of CH_4 (methane) slightly lower, 67 cm. per second. It would be extremely interesting to see similar curves for a dozen of the hydrocarbon groups commonly found in oil fuels.

Some combustion reactions take place so rapidly that they become practically instantaneous and are termed explosions. Others consume an appreciable time which can be calculated when the essential conditions are defined. At low temperatures of the order of 70° F., the rate of combustion approximately is doubled for each 20° F. increase in temperature. At higher temperatures, however, corresponding to those involved in oil-burner practice, it requires almost ten times this increase or a change nearly of 200° F. to double the rate.

BUREAU OF MINES EXPERIMENTS IN COAL COMBUSTION

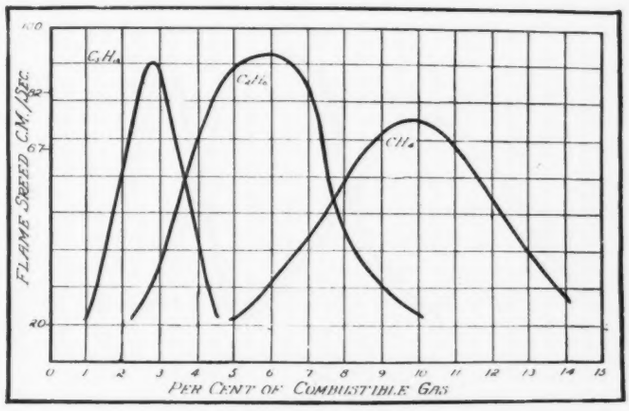
Some very interesting research work carried out in the Bureau of Mines by Kreisinger, Augustine and Ovitz, has brought out the interesting fact that in connection with the combustion of bituminous coal, the hydrocarbon methane (CH_4), which is distilled from the fuel, burns at the highest speed, hydrogen at a less speed, and carbon-monoxide at the lowest speed of the three. In addition to going



Flame Velocity in Air and in Mixtures of Air and Oxygen

through the process of hydroxylation, the oil fuel may, in the process of combustion, undergo "cracking," producing lighter hydrocarbons which either may be saturated or unsaturated, or under such conditions they may be broken up entirely into their elements, hydrogen and carbon.

F. H. Katz, of the Bureau of Mines, in carrying on some investigations concerning the speed at which heavy hydrocarbons are decomposed into their elements, has determined that only 0.036 seconds is required to break down heavy hydrocarbon at 2732° F. As this temperature comes within the range common in oil-burner practice, this is an interesting development. We, therefore, may conclude from this skeleton analysis that in the combustion of oil fuel, the production of soot is a matter of the physical conditions under which combustion takes place. If cracking is permitted, free carbon or soot will be the inevitable consequence,



Flame Velocities of Three Hydrocarbon Gases

while if combustion is controlled under conditions which cause hydroxylation to be carried on to the ultimate, no free carbon will be formed.

POWDERED COAL COMBUSTION CLOSELY APPROXIMATES OIL BURNING WITH "GUN" BURNER

From what has been said on the subject of atomization of oil fuel it is evident that, in the newly developed realm of firing with powdered coal, there are many problems quite parallel with those confronting the oil-burner engineer.

Oil is atomized for the purpose of so increasing the superficial area of any given quantity that radiant heat may act to quicken gasification. The pulverization of coal brings about a similar result. An ounce of anthracite coal occupies almost exactly a cubic inch. This volume has a surface area of 6 sq. in. If pulverized to the usual degree—to pass through a 200 mesh screen—the aggregate superficial area of this ounce of coal would be over 4,000 sq. in.

When pulverized coal is fired it is blown into the combustion chamber with primary air exactly as is the case with atomized oil. There is, however, this important difference—atomized oil requires but gasification to turn it into one of the three elementary fuels; powdered coal must have the volatile matter distilled out of it (this being gaseous hydrocarbons), leaving carbon in the form of coke. Thus, with coal, there are two combustion reactions, with a material residue, while, with oil, there is a simple, single reaction with practically no residue.

The speed with which the combustion of the solid portion of coal can be brought about is evident when we consider the minute size of the coke particle, raised to incandescence in the literally fiery furnace, and surrounded with oxygen heated through contact with the flying incandescent specks.

The powdered-coal combustion engineer is thus faced with a problem almost identical to that confronting the oil burner designer. He atomizes his fuel—at least in the same sense as does the liquid fuel engineer—by passing it through a screen of, say, 200 mesh. Then come the problems. If coal is crushed so that a given quantity will pass through this screen, how much of it is in pieces that *just* pass through; what per cent may be crushed to smaller sizes, and what are these sizes? What would be the result of firing a ton of coal in which every particle is of uniform size? What would be the difference if the particles were of various sizes, 10% of each size, each size 80% of the next larger? These and many correlated questions vex the technologists working to improve the burning of powdered fuel. Identical questions puzzle the engineers studying the combustion of atomized oil fuel.

RESEARCH MUST PAVE THE WAY FOR FUTURE DEVELOPMENTS

Much in the way of fundamental data remains to be worked out in the research laboratory before correct applications can be made to the machines that are to be sold to the public. The technique of the gasification of oil fuels should be mastered in the laboratory *on a scientific basis*—which means that the laws governing phenomena are determined in tangible form. Then desired actions or reactions can be brought about at will, instead of merely happening.

As cited in the previous article on this subject, internal-combustion engineers are working on this problem of heavy-oil gasification, with its preliminary step of atomization. The burning of powdered coal is predicated upon almost exactly similar mechanics and chemistry. The oil-burner engineer is going over the same ground as the internal-combustion engineer, except that, in internal-combustion practice, the oil is injected into compressed air rather than into air at atmospheric pressure. The rate of development in these three lines of endeavor, so important to the economical use of the natural fuels for heat energy and for power, will depend upon intelligent research rather than upon hit-and-miss experimentation.

Impending Changes in Our Use of Fuels

SINCE coal must remain for generations our chief energy source, the line of progress parallels that which leads to the better utilization of coal.

The smoke screen which enshrouds our cities, defiles our buildings, damages their contents, depresses our spirits, deprives us of the wholesome actinic rays of sunlight, and is a constant menace to health in other ways. Though general opinion is to the contrary, domestic heaters, including those of apartment houses, are responsible for the nuisance in larger measure than are the furnaces of industrial plants.

Foremost among the activities to find a substitute for anthracite through the conversion of soft coal to a smokeless fuel generally satisfactory to the householder, are the numerous processes for the so-called low-temperature carbonization of coal. Some 200 of such processes have been listed, but it is doubtful if 10% of that number have been operated on anything approaching the commercial scale. Their distinguishing characteristic is that the coal is carbonized at temperatures rarely exceeding 1100° F. As a result, there are obtained a moderate volume of gas of high heating power and valuable, in place of gas oil, for the enrichment of blue water gas, an excellent smokeless fuel in the form of semi-coke, and from 20 to 40 gal. of a thin tar per ton of coal. This tar is markedly different from ordinary coal tar and has, instead, much of the character of petroleum. It may be cracked to yield 22% of motor fuel of high anti-knock quality.

The process developed by Prof. S. W. Parr, of the University of Illinois, is the culmination of 25 years' study of the fundamental conditions involved in low-temperature carbonization. His process operates in two stages: A conditioning stage, in which the coal in a closed, rotating drum, is quickly brought to within 25°-50° of the temperature at which it becomes pasty, and a coking stage conducted in a vertical retort preheated to 750° C. Partly by reason of exothermic reactions within the coal, the heat strikes to the center of the mass in 10-30 minutes, with production of a dense, strong semi-coke from cheap Illinois screenings.

The method developed by McIntire, at Fairmont, W. Va., from the old Carbocoal process has a rather exceptional record in that some 25,000 tons have been processed. Its purpose is essentially that of making an artificial anthracite in the form of a briquetted smokeless fuel. It involves an initial low-temperature carbonization, with mechanical stirring of the plastic mass of hot coal. This stage of the process yields from 2000 lbs. of coal 1480 lbs. of semi-coke, 31 gal. of thin, light tar, and 2 gal. of light oil, together with about 3000 cu. ft. of gas of 950 B.T.U. The semi-coke is then briquetted with a binder of by-product pitch and reheated, at higher temperature, with further yield of 2000 cu. ft. of 450 B.T.U. gas and 8 gal. of heavy tar. The finished briquettes, containing 8-12% of volatile, are dense and smokeless.

The Green-Laucks process of the Old Ben Coal Corporation, as installed at Waukegan, Ill., passes a thin stream of coal upward by a screw within a vertical retort, 18 ft. high and 3 ft. in diameter, set in a furnace, the screw being heated through the shaft. The product of this pilot plant is said to be strong, dense and smokeless.—*From an address by Arthur D. Little before Engineering Foundation.*

Designing Steam Piping Systems

With Pipe Charts Based on Pressure-Drop and on Velocity of Steam Flow

By O. W. Motz

Mechanical Engineer in office of Harry Hake, Cincinnati, O.

PRACTICALLY all of the formulae for the flow of steam are based upon Bernoulli's theorem and the principle of the conservation of energy. Thus, if a fluid is flowing steadily through a pipe, the energy at any section, E_1, is equal to that at any subsequent section, E_2, plus the energy dissipated in overcoming friction, E_f, between the two sections. Or writing this symbolically,

$$E_1 = E_2 + E_f \qquad (1)$$

The design of a piping system depends upon the term E_f, or the quantity of energy which can be dissipated to overcome pipe friction. For a given flow, this quantity varies inversely with the size of the line, and the system must be designed economically to balance the cost of piping against the energy dissipated in friction.

In heating work the loss of energy is generally expressed in terms of pressure drop or velocity. These may be determined as follows:

The energy of a moving fluid is Wh, where W is the total weight and h is the head in feet. Assuming steady flow, we may write for equation (1)

$$Wh_1 = Wh_2 + Wh_f$$

or $h_1 = h_2 + h_f$ (Bernoulli's theorem)

The friction head, h_f, is given by Fanning and others as

$$h_f = \frac{fL2V^2}{Gd} \qquad (2)$$

Where h_f = friction head in feet
f = coefficient of friction
L = length in feet
V = velocity feet per second
G = acceleration due to gravity = 32.2
d = diameter of pipe in feet
also let p = pressure drop, pounds per square inch
D = density, pounds per cubic foot
W = weight of fluid flowing, pounds per minute
d_1 = diameter in inches = 12d

Then the pressure drop may be written

$$p = \frac{h_f D}{144} = \frac{fL2V^2}{Gd}\,\frac{D}{144} \qquad (3)$$

W = area × velocity × density

or $$W = 60V\,\frac{\pi}{4}\left(\frac{d_1}{12}\right)^2 \times D$$

from which $$V = \frac{9.6W}{\pi d_1^2\, D} \qquad (4)$$

Substituting (4) in equation (3) we get

$$p = \frac{0.04839fW^2L}{Dd_1^5} \qquad (5)$$

Many values for f have been advanced from experimental work but that of Unwin and Babcock is most generally accepted in the heating profession. Their value is

$$f = 0.0027\left(1 + \frac{3.6}{d_1}\right)$$

Substituting in (5) and solving for W, we get

$$W = 87\sqrt{\frac{PDd_1^5}{\left(1 + \frac{3.6}{d_1}\right)L}} \qquad (6)$$

In 1917, J. M. Spitzglass presented a formula of somewhat similar form, which is also widely used. His formula is

$$W = 60c\sqrt{\frac{pD}{L}} \qquad (7)$$

where c is a constant varying with the diameter.

Practically all present-day writers recommend the use of either equation (6) or (7).

The following is a brief comparison of the two formulae:

Substituting $$K = 87\sqrt{\frac{d_1^5}{\left(1 + \frac{3.6}{d_1}\right)}}$$

in the Babcock formula and K = 60c in the Spitzglass formula, we get a general formula

$$W = K\sqrt{\frac{pD}{L}}$$

The table on Page 76 shows the variation of K in the two formulae.

It is evident from the table, that the variation between the two formulae practically is negligible for pipe sizes most generally encountered in heating work. Furthermore, the correct solution of whichever formula is selected, and the proper estimation of the practical factors entering the designing of piping systems, are of greater importance. Accordingly, the writer has selected the Babcock formula equation (6) for pressure drop and equation (4) for velocity and has prepared nomographic charts to aid in the solution of the formulae.

VARIATION OF K IN BABCOCK AND SPITZGLASS FORMULAE

Nominal Diameter In.	Actual Inside Diameter In.	$K = 87\sqrt{\left(1 + \frac{3.6}{d}\right)}$	$K = 60c$
1	1.049	46	45
1½	1.61	159	150
2	2.067	322	306
2½	2.469	532	510
3	3.068	972	930
3½	3.548	1410	1380
4	4.026	2016	1950
5	5.047	3724	3600
6	6.065	6210	5820
8	7.981	13000	11700
10	10.02	23600	21000
12	12.00	38000	33000
14	14.00	56800	48000

APPLICATION OF CHART BASED ON PRESSURE-DROP METHOD

The following pertains to their practical application.

Chart 1. Chart 1 is for use in sizing pipe by the so-called pressure-drop method. The chart consists of graduated lines for each of the five variables in the Babcock formula and also two ungraduated lines. When four of the variables are known, the other can be determined by properly connecting the four known points with straight lines, as shown in the small sketch on the chart. It is not necessary to refer to a steam table to obtain the density corresponding to the pressure in the steam main as this scale is double graduated, one side for gauge pressure and the other for density. The scale for W, pounds of steam flowing per minute, is also double graduated. On one side is the theoretical pounds of steam flowing per minute. The other side is graduated for square feet of radiation with 20% deducted as a factor of safety for variation in pipe, corrosion, scale, condensation, and other factors.

The application of the charts in sizing heating lines is separated into various steps as shown below. The various tables are offered as a general guide and for convenient reference. Individual

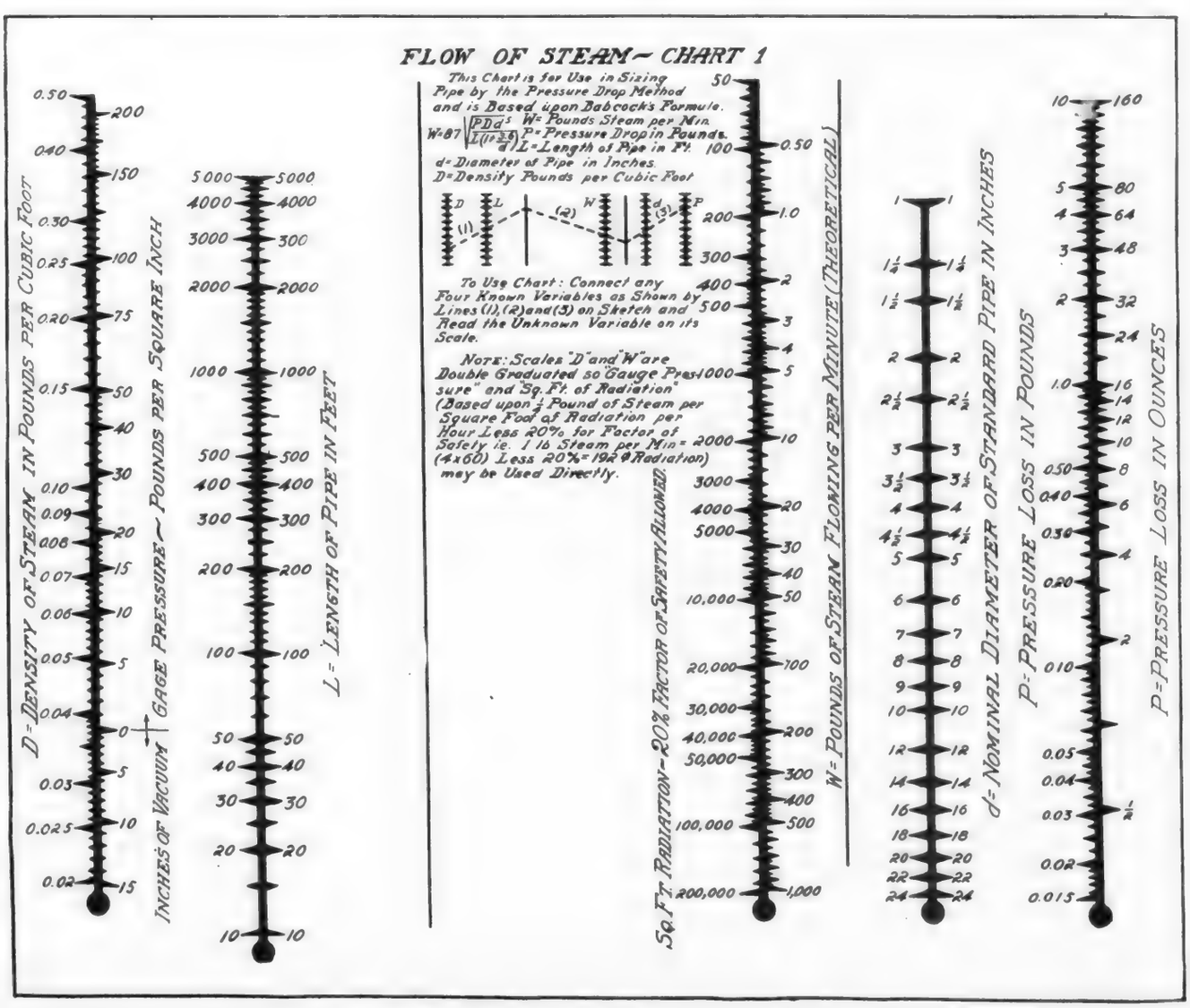

FLOW OF STEAM — CHART 1
This Chart is for Use in Sizing Pipe by the Pressure Drop Method and is Based upon Babcock's Formula.
W = Pounds Steam per Min.
P = Pressure Drop in Pounds.
L = Length of Pipe in Ft.
d = Diameter of Pipe in Inches.
D = Density Pounds per Cubic Foot
To Use Chart: Connect any Four Known Variables as Shown by Lines (1), (2) and (3) on Sketch and Read the Unknown Variable on its Scale.
Note: Scales "D" and "W" are Double Graduated so "Gauge Pressure" and "Sq. Ft. of Radiation" (Based upon ¼ Pound of Steam per Square Foot of Radiation per Hour Less 20% for Factor of Safety i.e. 1 lb Steam per Min = 2000 (4x60) Less 20% = 1920 ♯ Radiation) may be Used Directly.
D = Density of Steam in Pounds per Cubic Foot
Inches of Vacuum — Gage Pressure — Pounds per Square Inch
L = Length of Pipe in Feet
W = Pounds of Steam Flowing per Minute (Theoretical)
Sq. Ft. Radiation — 20% Factor of Safety Allowed
d = Nominal Diameter of Standard Pipe in Inches
P = Pressure Loss in Pounds
P = Pressure Loss in Ounces

Chart 1 for Sizing Pipe by the Pressure-Drop Method

problems should be carefully analyzed and proper judgment used in selecting values.

(1) Select the initial steam pressure, using the following table as a guide:

Small gravity and vapor systems.....½–¾ lbs.
Ordinary vapor systems.....1–1½ lbs.
Vacuum systems .....1½–2 lbs.
System with pressure-reducing valve...1½–2 lbs.

The value plotted on the chart should be the average pressure in the main, not the boiler pressure.

(2) Determine the total equivalent length of the steam main from the boiler to the farthest radiator, assuming temporary sizes, for making allowance for fittings, using the table in next column.

(3) Select the pressure-drop to be allowed. In general, the pressure-drop should not exceed 1 oz. per 100 ft. of straight pipe or equivalent. The following table serves as a guide for the total pressure drop to be allowed:

LENGTH IN FEET TO BE ADDED TO RUN

Size of Pipe In. Diam.	Standard Elbow	Side Outlet Tee	Gate Valve	Globe Valve	Angle Valve
2	5	16	2	18	9
2½	7	20	3	25	12
3	10	26	3	33	16
3½	12	31	4	39	19
4	14	35	5	45	22
5	18	44	7	57	28
6	22	50	9	70	32
7	26	55	10	82	37
8	31	63	12	94	42
9	35	69	13	105	47
10	39	76	15	118	52
11	47	90	18	140	63
12	53	105	20	160	72

Small gravity and vapor systems.....2 oz.
Ordinary vapor systems.....4 oz.
Vacuum systems .....8–10 oz.
System with pressure-reducing valve.....8–10 oz.

(4) We can now locate three points on the chart —gauge pressure, length, and pressure-drop. Next, use each diameter of pipe as the fourth known variable and use the chart to make a table of the amount of radiation which each size of pipe will

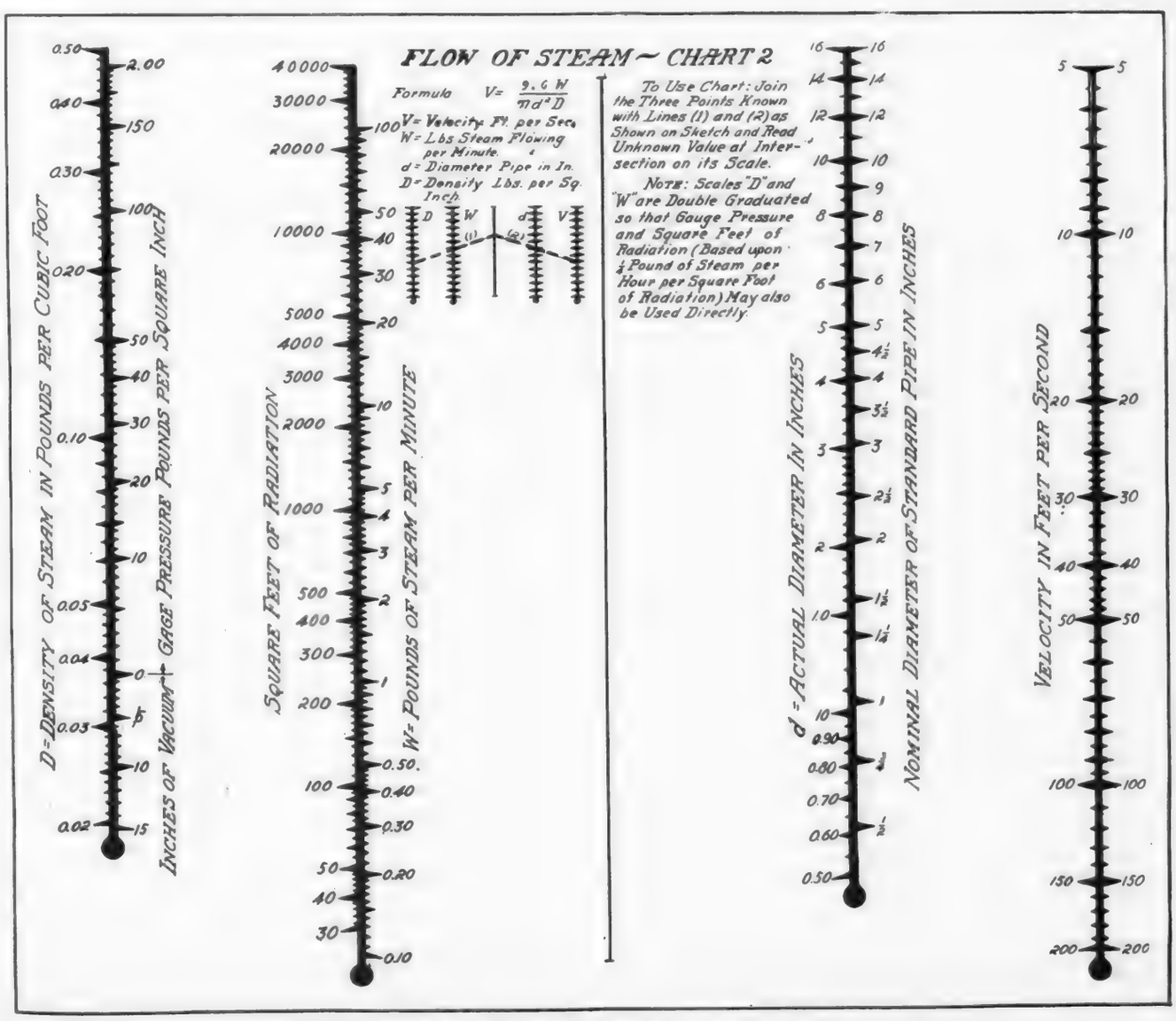

FLOW OF STEAM ~ CHART 2
Formula V = 9.6 W / π d² D
V = Velocity Ft. per Sec.
W = Lbs. Steam Flowing per Minute.
d = Diameter Pipe in In.
D = Density Lbs. per Sq. Inch
To Use Chart: Join the Three Points Known with Lines (1) and (2) as Shown on Sketch and Read Unknown Value at Intersection on its Scale.
Note: Scales "D" and "W" are Double Graduated so that Gauge Pressure and Square Feet of Radiation (Based upon ¼ Pound of Steam per Hour per Square Foot of Radiation) May also be Used Directly.
D = Density of Steam in Pounds per Cubic Foot
Inches of Vacuum — Gage Pressure Pounds per Square Inch
Square Feet of Radiation
W = Pounds of Steam per Minute
d = Actual Diameter in Inches
Nominal Diameter of Standard Pipe in Inches
Velocity in Feet per Second

Chart 2 for Sizing Pipe by the Velocity Method

serve. For example, assume a gauge pressure of 1 lb., length of run 200 ft. and pressure-drop 2 oz. Let the diameter be 2, 3, 4, 6, etc. Then from the chart a 2-in. pipe will serve 310 sq. ft., a 3-in. pipe, 930 sq. ft., a 4-in., 1900 sq. ft., a 6-in., 5800 sq. ft., etc.

Next, starting at the farthest radiator, subtotal the radiation as each riser is picked up and size the main according to this table.

(5) The remaining risers should then be sized to give the same total pressure-drop between the steam supply and the farthest radiator on every riser. This necessitates throttling of risers near the steam supply. However, this throttling must not be sufficient to increase the velocity to a point where it will cause noise or entrainment of condensation, as discussed later under Chart No. 2.

In general, determine the equivalent length of the steam main between the steam supply and the base of the first riser and also the total load on the main at the boiler (from step 4). Knowing gauge pressure, length, square feet of radiation, and diameter, use the chart to find the pressure-drop in this section of the main. The riser should then be sized for a pressure-drop equal to the total drop minus the drop in the main between the riser and the boiler. Next, find the pressure-drop in the main between the first and second risers in a similar manner; add the drop between the first riser and the boiler to get the total drop at the base of the second riser and size the riser as above. Continue this method for other risers. The velocity in these risers and the radiator run-outs should then be carefully checked as described under Chart. No. 2.

APPLICATION OF CHART BASED ON VELOCITY METHOD

Chart 2. Chart 2 is for use in sizing pipe lines by the velocity method and is based upon formula:

$$V = \frac{9.6W}{\pi d_1^2 \quad D}.$$

This chart has four graduated scales, one for each variable in the formula. When any three of the variables are known the other can be determined by properly connecting the three known points with straight lines, as shown in the small sketch on the chart. The scales for density and pounds of steam are double graduated so gauge pressure and square feet of radiation may be used directly.

The velocity of the steam in certain parts of the heating system should be carefully checked or serious trouble may be encountered. This applies especially where condensation and steam are flowing in opposite directions, as in horizontal radiator run-outs, upfeed risers, and horizontal branches of risers. High velocity in such places may cause the condensation to be carried along by the steam, resulting in objectionable noise. The velocity at such points must not exceed the critical velocity, approximately 20 ft. per second.

The velocity can be considerably higher in lines where the condensation and steam are flowing in the same direction, as in the steam mains and downfeed risers. Usually, if these lines are sized by the pressure-drop method, as outlined above, the velocity will vary from 25 to 50 ft. per second and should seldom exceed the latter value.

The velocity at the boiler nozzle also should be checked, as high velocity may cause the entrainment of water with the outgoing steam, resulting in excessive priming. This applies principally to boilers having small steam liberating space. In such boilers the outlet velocity should not exceed 16 or 20 ft. per second.

Chart 2 was made primarily for use in checking the velocity of steam in pipe lines. Thus, if the line is first sized by the use of Chart 1, gauge pressure, square feet of radiation, and diameter will be known and the velocity can then be determined by using these values on Chart 2.

In applying the above data the writer recommends that Chart 2 be used in preparing a table showing the maximum amount of radiation which can be placed on pipes of the various diameters without exceeding the critical velocity. The lines should then be sized by the method explained under Chart 1, using care not to place more radiation on a pipe of given diameter than is shown by the table.

Drying Lumber with Electric Heat

BY the use of electric heat for drying its lumber, the Chicago Lumber Company, of Oakland, California, has found it can dry its lumber in two days' time, without damaging the wood, and with low operating costs. This company has made two installations of electric lumber-drying equipment in its plant.

The drying box used has dimensions approximating 10 ft. wide by 7 ft. high and 21 ft. long. It is constructed of ship-lap, backed by moisture-proof paper, and insulated with packed shavings. The lumber to be dried is principally short lengths

Electric Lumber Drying Box in Plant of Chicago Lumber Company

Electric Heating Units for Lumber Drying Box

used, after drying, to make up window and door casings.

Moisture equivalent to 5% of the weight of the dry lumber is removed, it is stated, within 48 hours without end-checking or other damage to the lumber. It was estimated before installation that the drying would require 100 K.W.H. per 1,000 board feet of lumber, but actual operation has shown a much better economy. The cost of power is 1.15 cents per K.W., comparing favorably with the cost of oil at $1.25 per barrel of 42 gal.

Four General Electric form G oven heaters comprise the heating elements, with a total connected load of 15 K.W. The temperature is controlled automatically at 90° F. at the beginning of the drying cycle and at 120° F. near the end of the period.

AIR CIRCULATION BY NATURAL DRAFT

Cold air is drawn in by natural draft through four openings in the floor of the drying compartment, and a heater is placed over each opening. The moisture-laden air escapes through an opening in the roof, so located that the air must pass over the lumber before it is ejected. A temperature controller, with a sensitive bulb 25 ft. long, is spread out over the ceiling of the compartment and thus controls the average temperature over the whole of the drying box.

Lumber is run into the drying compartment on trucks and is so loaded as to give ample space around each piece to allow free air circulation.

Electric heating units are also installed in the company's glue room where window and door sash parts are glued together. In this room (20 ft. by 60 ft. by 12 ft.) it is necessary to keep the air heated so that the glue may be dried thoroughly by the time the sash has passed from one end of the gluing machine to the other.

The heating equipment consists of eight General Electric form G heating units mounted in a Sturtevant specially-constructed blower equipped with a 20 in. motor-driven fan. The fan, motor, and heating units, taking up a space of but 30 in. by 34½ in. by 27 in., are installed near the ceiling at one end of the room.

In operation the fan draws cold air over the heater and the heated air is blown directly toward the opposite end of the room, thus bringing the air in direct contact with the sash passing through the gluing machine. The temperature is maintained at 85° F.

Purdue's New Central Heating Plant

(*Continued from Page* 71)

along the railroad spur and near the power plant. This is now under construction and when completed will hold 4000 tons of coal with a maximum depth of 10 ft. An 18-ton gas locomotive crane with a bucket of 1¼ cu. yds. capacity will operate between the pit and the conveyor.

Two 500-K.W. turbo generators and one 1000 K. W. turbo generator, complete water-works service and fire protection pumps are found in the engine room. The turbines will operate non-condensing during the heating season and condensing during the non-heating season. A cooling pond is installed and in use for condensing service.

The concluding installment of this article will describe the routing of the steam lines, the steam requirements of the various groups, the determination of sizes, and the presentation of the exact cost of materials, equipment and installation.

Fig. 3. The New Steam and Power Plant at Purdue University. The Old Plant Shows in Background

This is the twenty-fifth lesson of The Heating and Ventilating Magazine's

New Home-Study Course in Gravity Steam and Water Heating

Lesson No. 25—Chimneys*

By Ara Marcus Daniels

NOTHING contributes more to successful boiler operation than a proper and suitable chimney, and nothing can affect the operation of an otherwise correct heating installation more detrimentally than a chimney that fails to fulfill its functions.

Primarily, the functions of a chimney are twofold. They are, (1) to provide suitably for discharging the wholly or partly-burned gases from the boiler so that they will not be harmful or objectionable, and (2) to assure the production of a draft sufficient to maintain a rate of fuel consumption economically consistent with heating demands.

Blame for an unsatisfactorily-heated structure is often laid upon the boiler installed. The heating contractor not infrequently is accused of having used an undersize or inefficient boiler when the fault lies entirely with the chimney. And it is a pity that so often the heating contractor is incapable of explaining and demonstrating the effect of chimney action on boiler operation. It is essential, therefore, that the relation between chimney and boiler be understood and it be realized that the design, location and construction of the chimney and flue are the keystones on which the successful fulfillment of a heating contract guarantee rests.

The ideal and most efficient chimney is built vertical with round flue and smooth interior surfaces. Such a flue offers least resistance to the ascending column of smoke and gases and, consequently, is more efficient than a flue with square or oblong cross-section.

EXAMPLES OF CHIMNEY SHAPES

Four examples of chimney construction are shown in Fig. B-2-1. The round chimney shown at A is seldom found in residential or medium-size buildings since it is more costly and the erection more difficult than that of a square or oblong chimney. The square chimney shown at B is next to be preferred to the round. It must have greater area than the round for the same capacity. It offers greater resistance to the passage of the smoke and gases. The next preferable shape is shown at C as an oblong chimney. This type, perhaps, is most frequently used, since the brick work can be handled quite advantageously. Effectiveness of an oblong chimney decreases rapidly as the difference between its length and width increases. Therefore, the use of a chimney with length in excess of 4 in. greater than the width should be questioned. The type shown at D represents poor chimney construction. Friction losses are high and capacity correspondingly low. Chimneys of these proportions always should be avoided.

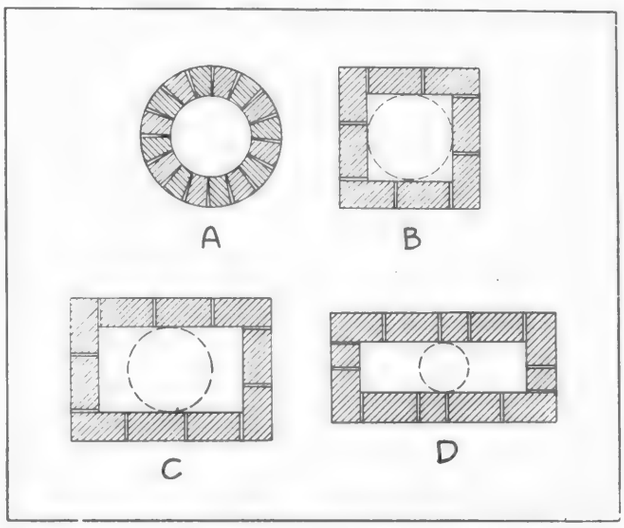


Fig. B-2-1. Types of Chimney Construction

Work Problem B-2-1

FLUE LININGS

All chimneys should have lined flues. The use of flue linings reduces the fire hazard and affords improved draft conditions. Dimensions for rectangular and round fire-clay linings have now been standardized by the Eastern Clay Products Association.* In arriving at the standardization adopted, the association was guided by the sizes of common and face brick.

Standard sizes of rectangular fire-clay flue linings are shown in Fig. B-2-2, while Fig. B-2-3 shows standard sizes for the round linings.

*Copyright 1927, Ara Marcus Daniels.

*"Flues and Flue Linings—Chimneys and Fireplaces." Price $1.00, contains valuable information on chimneys and flues.

Flue linings should be made of fire clay and specifications should read "fire-clay flue lining." It is a mistake to call for or permit the use of "flue-tile," "terra-cotta" flue lining, "clay" flue lining, "burned clay" flue lining or any similar product. Fire-clay flue lining is superior for chimney construction since it is made of a special mixture of clays thoroughly burned to withstand fire and heat, sudden or slow changes in temperature and all actions resulting from fire, smoke, gases or acids. It does precisely what unprotected mortar joints fail to do.

Work Problem B-2-2

FAULTY CHIMNEY CONSTRUCTION

Paradoxical as it may seem, a faulty chimney practically always shows its shortcomings through its effect upon some other feature of the plant. The fact that a lighted newspaper thrust into the bottom of a chimney will be sucked up and consumed with a roar is often erroneously taken to indicate a good draft. And because of this seemingly good "pull" the owner and general contractor often will emphatically insist that the draft is good. There is only one way to know whether the draft is good and that is to measure it. And the only proper way to measure it is by means of a suitable draft gage. Such an instrument is indispensable to every real, actual, virtual, or so-called heating engineer or contractor.

DRAFT

Before familiarizing the student with the use of the draft gage, let him first understand what draft is, what causes it and why it is essential.

Draft is a current of any sort. In a chimney flue, it is a current of smoke or products of combustion flowing from an enclosed or confined space into an open space or the atmosphere. The flow or movement is caused by the difference in pressure that exists in the confined space and that existing in the open space. This pressure difference is due to the fact that the weight of unit volume of a gas depends upon its temperature. For example, 1 cu. ft. of dry air at a temperature of 0° F. weighs 0.08636 lb. whereas the same air at a temperature of 300° F. weighs only 0.05225 lb.

Work Problem B-2-3

If the boiler-chimney system shown in Fig. B-2-4 is considered as immersed in the atmosphere, then the pressure exerted on each square inch of surface will be equal to atmospheric pressure, commonly taken at 14.7 lbs. per square inch. This pressure, as indicated, acts in the combustion chamber through the chimney, as well as through the ashpit, and so long as there is no fire in the boiler, air temperatures within and without are the same, no pressure difference exists, and hence there is no draft and the levels in all U-tubes (explained later) are the same.

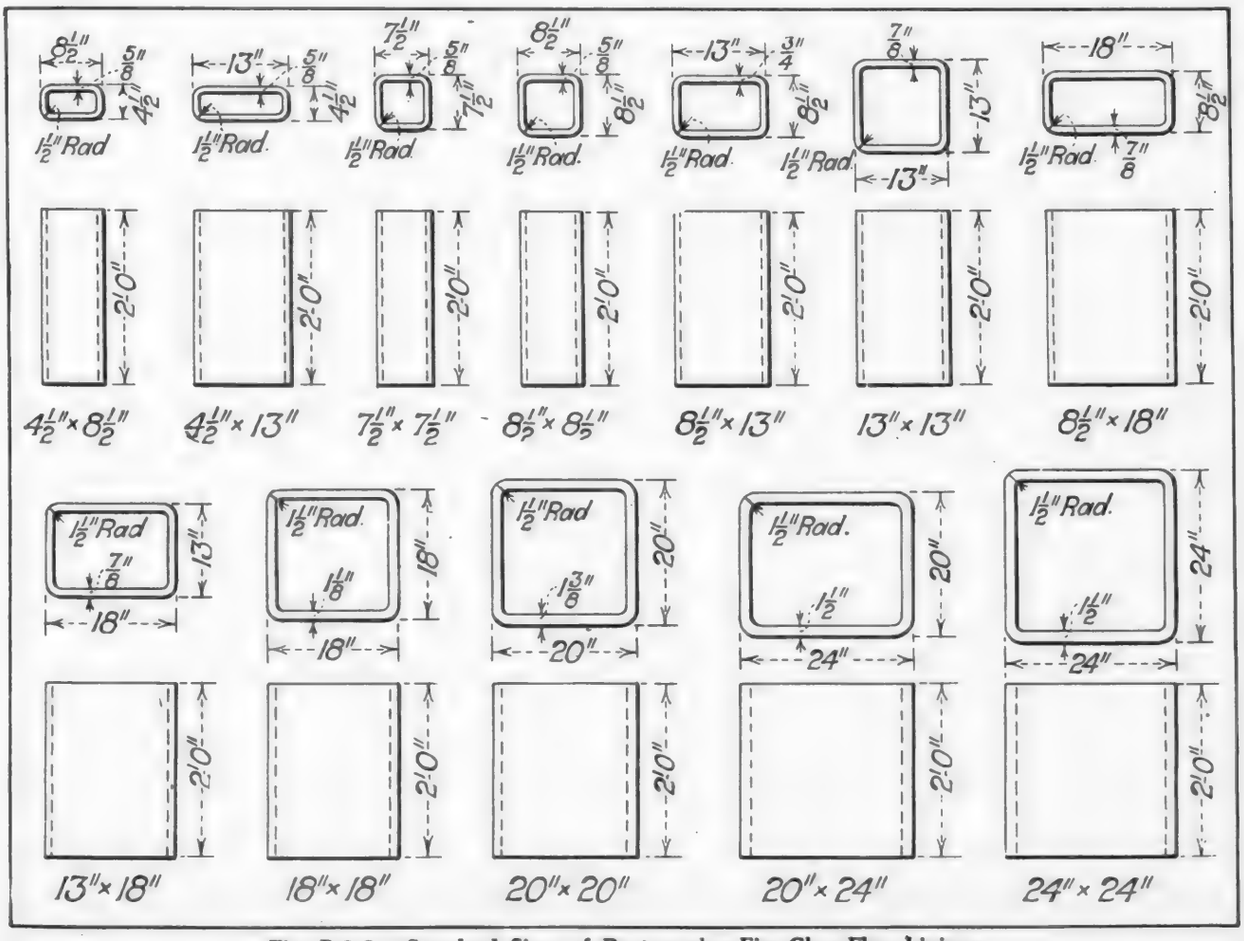


Fig. B-2-2. Standard Sizes of Rectangular Fire-Clay Flue Linings
(Eastern Clay Products Association)

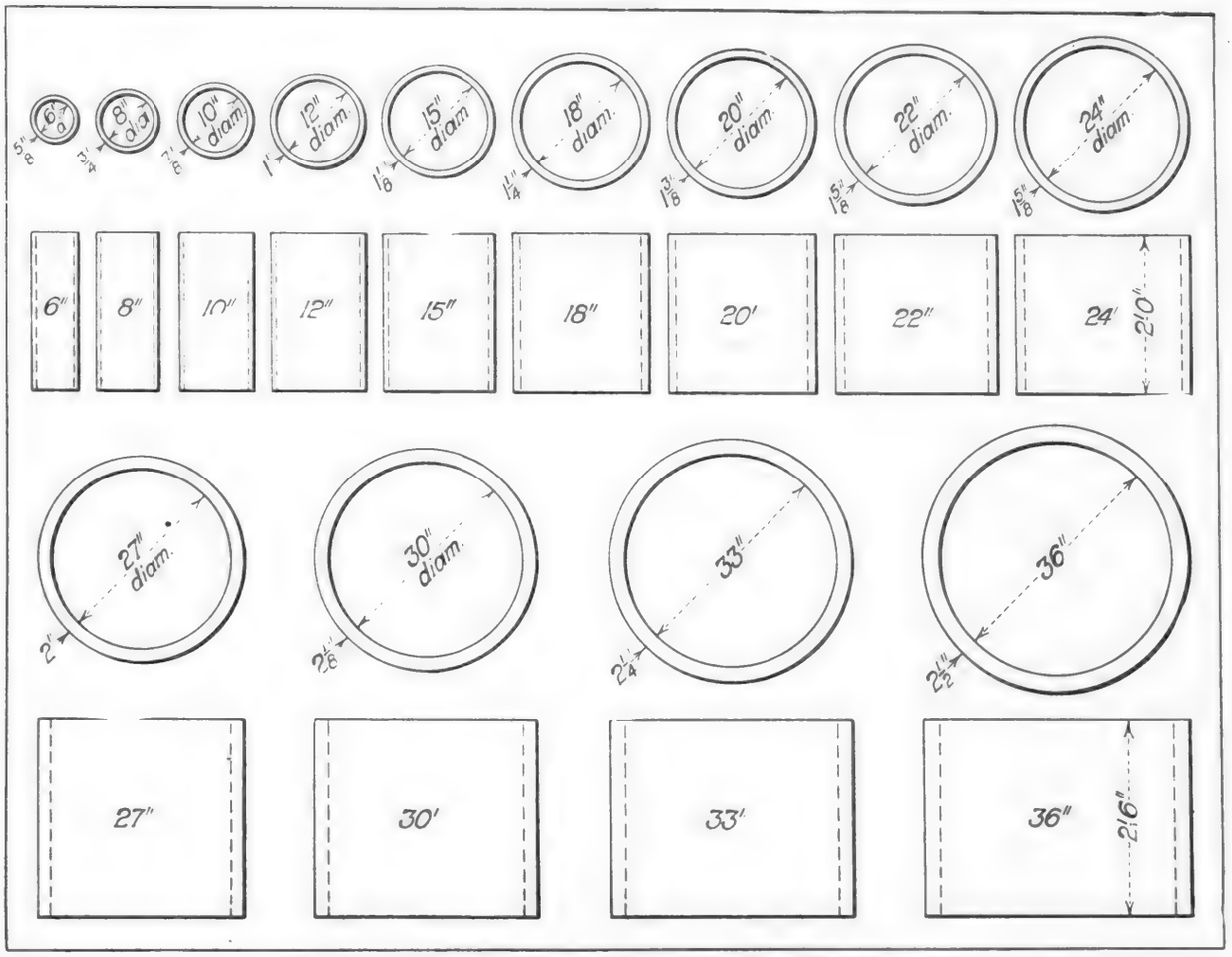


Fig. B-2-3. Standard Sizes of Round Fire-Clay Flue Linings
(Eastern Clay Products Association)

With a fire in the boiler, conditions are quite different. In Fig. B-2-5, there is illustrated diagrammatically how draft occurs. At A, V_1 and V_1 represent equal volumes of air (1000 cu. ft.), each having a temperature of 0° F. If containers are assumed weightless and flexible and the weightless rigid bar MN, resting on knife edge K, supports the two volumes on frictionless bearings, then each of the assumed volumes will exert the same pressure, 86.36 lbs. at the same distance from support and thus be in equilibrium so there will be no tendency of movement in either direction. This is the condition that exists in a cold boiler-chimney system with the temperature the same inside as outside the flue.

If the temperature of one of the V_1 volumes be raised to 300° F., its volume will increase from 1000 cu. ft. to approximately 1600 cu. ft., as represented by volume V_2 and V_3 at B of Fig. B-2-5. Thus the weight of unit volume has been decreased on the hot side since 1 cu. ft. of gas at 300° F. weighs only 0.05225 lb. as compared to 0.08636 lb. at 0° F. The weights on the two sides are the same unless the increase of volume on the hot side is allowed to escape.

If this is assumed to happen, the result will be as shown at C, Fig. B-2-5 where the 1000 cu. ft. of air or gas at 0° F., weighing 86.36 lbs. overbalances the 1000 cu. ft. at 300° F., weighing 52.25 lbs. and there is a tipping of the bar. A condition of unbalanced pressure exists and the lighter volume V_2 is pushed upward.

By considering the bottom end of container V_1 as connected to the ashpit of a boiler and the upper end of V_1 opened to the outside atmosphere, while the bottom of container V_2 is connected to the smoke pipe of the heater, with the upper end opened to the outside atmosphere, there would be a tendency to movement down the V_1 side, through the heater and up the V_2 side. This flowing tendency is the draft and, as explained, is caused by the difference in weight between a volume of air on the outside of the chimney flue and an equal volume of products of combustion from the fire on the inside.

Thus, this condition of unbalanced pressure at the base of the stack persists so long as the tem-

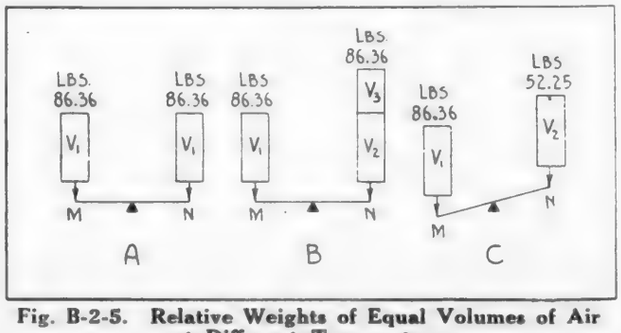


Fig. B-2-5. Relative Weights of Equal Volumes of Air at Different Temperatures

perature of the air and gases that enter the heater is raised therein. This is the basic principle which governs chimney action and upon which the draft depends. The greater the difference between the temperature in the flue and that outside, the greater the persistency of unbalanced pressure and hence the better the draft.

Work Problem B-2-4

THE U-TUBE

Fig. B-2-6 shows a U-shaped glass tube open at both ends A and B. A double scale, fitted to a thin piece of wood and mounted as indicated, is graduated in inches and in tenths of an inch. The glass tube is often about ½ in. in diameter. It contains just sufficient water so that when the tube is held in a vertical position, with each end open to the atmosphere, the level of the water in the two sides will agree with the zero on the scale. Such an instrument is called a U draft gage.

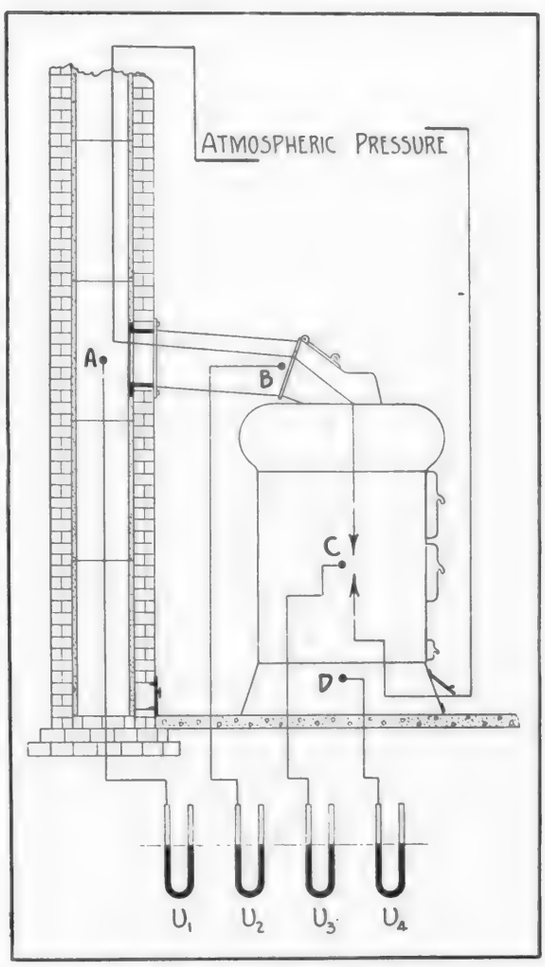


Fig. B-2-4. Boiler-Chimney System

If the end B of such a gage is connected, as indicated in Fig. B-2-7, into a chimney flue up which hot gases are passing and the end A is open to the atmosphere, the pressure of the colder and heavier atmosphere will cause the level of the water to rise in one leg and lower a corresponding amount in the other leg. The difference in elevations of the

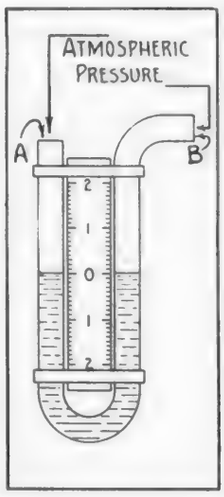


Fig. B-2-6. Construction of U-Tube

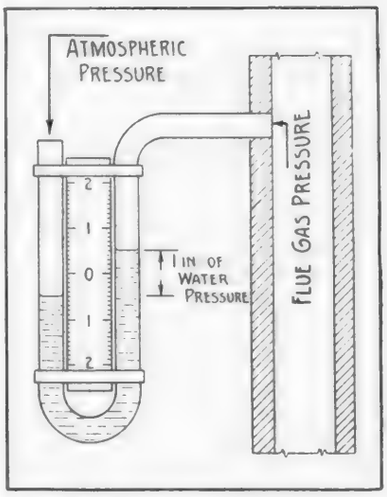


Fig. B-2-7. U-Tube Connected to Chimney Flue

two water levels is an exact measure of the draft. The position of the levels in Fig. B-2-7 indicates a draft of 1 in. of water.

Work Problem B-2-5

THE DRAFT GAGE

The principle of the U-tube is used in all draft gages. Various designs are available. They have been developed because draft intensities in most chimneys are very low, from 0.01 to 0.20 in. of water and it is very difficult and practically impossible to determine with accuracy these small differences in level by means of the ordinary U-tube. Standard draft gages, therefore, are usually made with one inclined leg with a tube of small bore filled with a liquid which is lighter than water. Thus the difference in level will be magnified and more accurate reading is assured. Graduations are made so that the readings indicate inches of water exactly as with a U-tube. Care must be exercised in the use of a draft gage, else results may be questioned. Complete instructions are contained in the literature of draft gage manufacturers. A gage of the portable type, readable to 1/100 in. is illustrated in Fig. B-2-8.

Work Problem B-2-6

(To be continued)

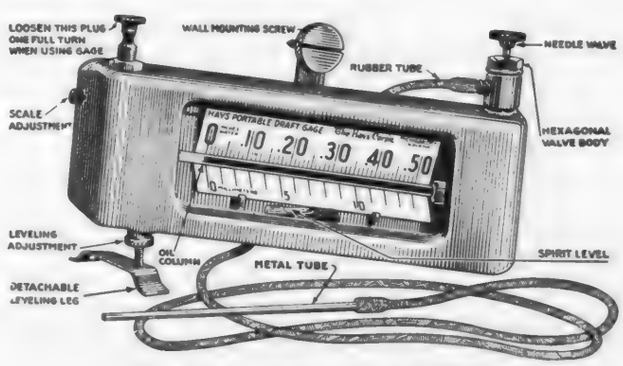


Fig. B-2-8. Portable Draft Gage
(Courtesy The Hays Corporation)

PIPECRAFT

PART VI

IN the previous articles in this series, the subjects treated have all related to risers and radiator runouts. It is now desired to take up the even more important subject of mains and apparatus connections. The phrase "more important" is used purposely in connection with this portion of the work because the pipe sizes usually are larger, and any difficulties occurring in the mains in all probability will affect a larger number of units than would be interfered with if the trouble were located in a riser.

With this in view, whatever care is exercised in the riser installation must be redoubled for the work on the mains if a "first-class, workmanlike job" is ultimately to be produced. Fortunately, where the larger mains are to be handled, the space conditions seldom are as cramped as with the risers. In many cases the whole ceiling practically is clear for the running of the mains and, outside of avoiding deep girders and maintaining headroom, little outside interference is met.

Having carried the risers down to a point where they are ready for connection with the main it will first be necessary to decide how the riser runout shall be made as a branch from the main before the main itself can be considered. This is for the reason that the runout may be arranged so as to drain the main or it may be arranged so as to carry the steam only over to the riser, in which case the main, of course, must be pitched and especially dripped at one or more points.

As a one-pipe steam system is the simplest of steam piping systems, the method of making runouts from such a main will be taken up for discussion first.

Runouts for One-Pipe Gravity Steam Systems

In the one-pipe gravity steam system it is necessary to carry the water of condensation back in the same pipe through which the steam is supplied —hence the name, "one-pipe"—and this fact has a strong bearing on the type of runout used. Besides this, the one-pipe system generally is used for smaller installations and the practice is almost universal of pitching the steam main down toward the far end and running back a wet return from that point.

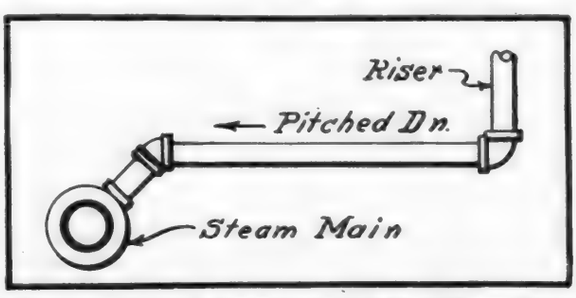


Fig. 44. Correct Arrangement of Riser Runout for One-Pipe Gravity Steam System

With this in mind, it is seen that little would be gained from trying to drip the main at every branch, as this would necessitate a *separate* return main, the expense of which is unwarranted in the small job. Practical experience has shown that the best type of riser runout for this class of system is that illustrated in Fig. 44, where the branch leaves the main through a tee turned up at a 45° angle toward the riser, with a 45° ell on the top of a short nipple, from which fitting the runout extends with an upward slope to the riser.

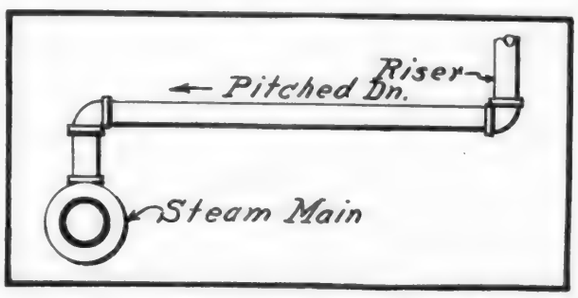


Fig. 45. This Form of Riser Runout Causes the Condensation to Flow Back Against the Steam

By making these branches about 5 ft. long, and keeping the expansion movement in the main down to a reasonable amount, the spring in the branch pipe is sufficient to prevent any difficulty on that score. It will be noted that when the branch is made in this form the returning condensation has a smooth and almost uninterrupted flow from the riser back to the bottom of the steam main, *without crossing the flow of steam.* If the branch is taken from the top of the main, as indicated in Fig. 45, then the water flowing back falls directly into the steam flowing along the main and interferes with the supply to radiators farther along the line.

Runouts for Two-Pipe Gravity Steam Systems

Two-pipe gravity steam systems are seldom installed nowadays in up-to-date work; years ago they were considered as the only answer when the installation became too large for a one-pipe layout, but later they were largely displaced by vacuum heating. The chief difficulty which used to develop was the closing of the automatic air-valve on the return end of the radiator caused by the steam back-firing through the return connection before the radiator was cleared of air.

In an endeavor to prevent this, various types of water seals were evolved and applied to the returns

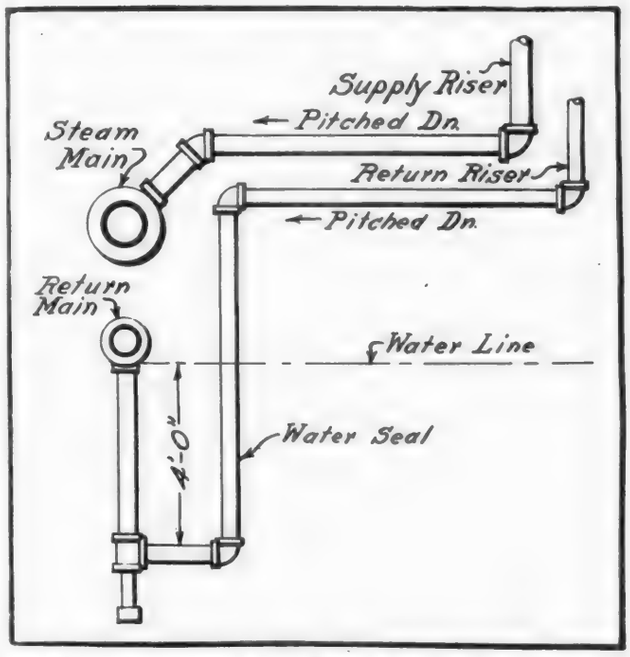


Fig. 46. Runout with Water Seal for Two-Pipe Gravity Work

to prevent the steam from getting into these return lines too quickly. One of the expedients used was to make a loop or water-seal at the point where each return connected to the return main, and, naturally, this produced an effect on the return runout. Whereas the supply runout was made in the same manner as the one-pipe steam runout, already shown in Fig. 44, the return runout was modified so as to include a 3-ft. or 4-ft. water-seal, as illustrated in Fig. 46; this water-seal was supposed to be deep enough to prevent steam from blowing through the seal and entering the return line. Even if it did blow through once in a while, the seal immediately refilled and again offered its resistance to steam continuing to enter the return line.

Runouts for Vapor Heating Systems

With vapor systems there are several ways of treating the runouts, depending somewhat on the particular type of vapor system used. In general, as there is no radiator condensation coming back down the supply riser, the supply branch may be taken off as already illustrated for one-pipe systems in Fig. 44, or may be taken off the top of the main as shown in Fig. 47. When the return main is a dry return and is run overhead, the return branches may be taken off in the same manner, while, if a wet return is used, an air line must be provided to take care of the air coming down the return risers, as shown in Fig. 48. This air line must be kept high enough not to be flooded when the condensation rises in the return, due to increase in the steam pressure where an automatic return trap is not installed.

All runouts in such vapor systems should pitch up toward the riser on both the supply branch and the return branch, allowing the riser condensation to drain back to the main, except where return branches have the air connection provided; in that case the branch may slope toward the wet return so as to drain the riser condensation down into the wet return.

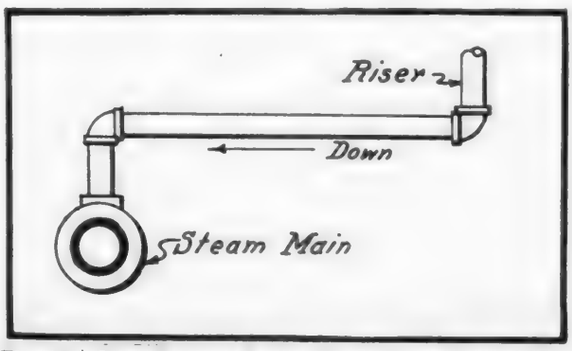


Fig. 47. How Runout May be Taken from Top of Main in a Vapor Heating System

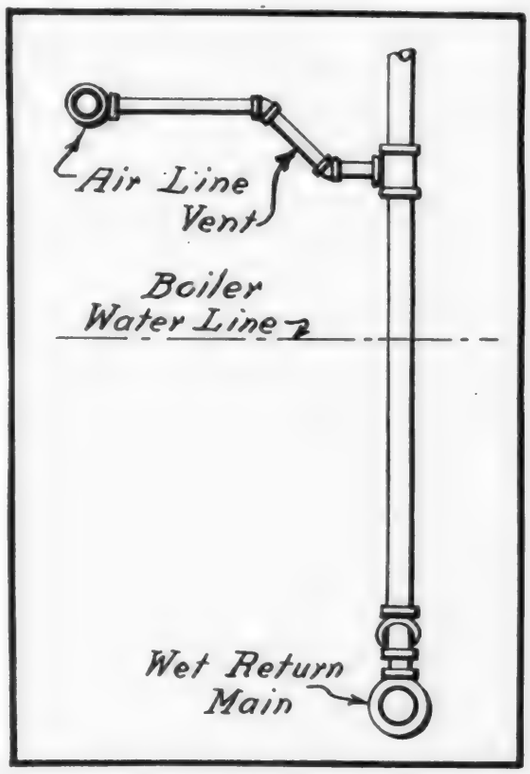


Fig. 48. Air Line for Wet Return of Vapor Heating System to Take Care of Air Coming Down Return Risers

Runouts for Vacuum Heating Systems

In vacuum steam heating the installations are usually of considerable size and, therefore, often are provided with valves so that the riser may be cut off for repairs or when certain portions of the building do not require heat. The supply risers also are generally high enough to justify dripping the base and this also modifies the type of runout.

It is an absolute requirement in all vacuum systems that there shall be no direct connection between the steam side and the return side of the system, except through a suitable trap. The trap used, in most cases, is of the thermostatic type or —where condensation only is to be handled—of the float type. Some of the float traps also have

an integral thermostatic bypass to take care of air as well as condensate and these traps are very desirable, as air may sometimes be caught at the trap unless this feature is incorporated.

In Fig. 49 is shown the simplest form of runout for a vacuum system *without* shutoff valves and with a short riser which does not require a base drip to prevent excessive amounts of condensation from bucking against the steam flow in the horizontal branch. This runout may also be made with the use of a 45° ell, as already illustrated in Fig. 47 for vapor steam systems. Where higher risers are encountered the runout should be dripped, as shown in Fig. 50.

In cases where it is desired to valve the risers the valves should be placed as indicated in Fig. 50, and not on the horizontal branch; this is because the horizontal branch customarily is used to drip the main, as well as to supply steam to the riser and, in such cases, the placing of the valve in the horizontal pipe would not only kill the drip but would also allow a slug of water to accumulate in the horizontal pipe back of the valve; this slug would have to be drained whenever the valve was opened, with the probable result of water hammer.

In dripping the bottom of supply risers the best practice involves the placing of a short branch or a water-seal between the riser base and the drip trap. This is particularly important with thermostatic traps and is for the purpose of allowing the riser condensation an opportunity to cool off slightly by radiation before it reaches the trap. It must be remembered that thermostatic traps are temperature traps and are not operated by water; on the contrary, they are arranged to pass air just as well as water and, if the water is practically at steam temperature when it reaches the drip trap, the chances are that the riser will be partly filled with water all the time. Whether this water will accumulate to such an extent as to give serious trouble is a matter depending on each individual case and the local conditions.

The writer has seen many cases where drip traps have been installed without such cooling

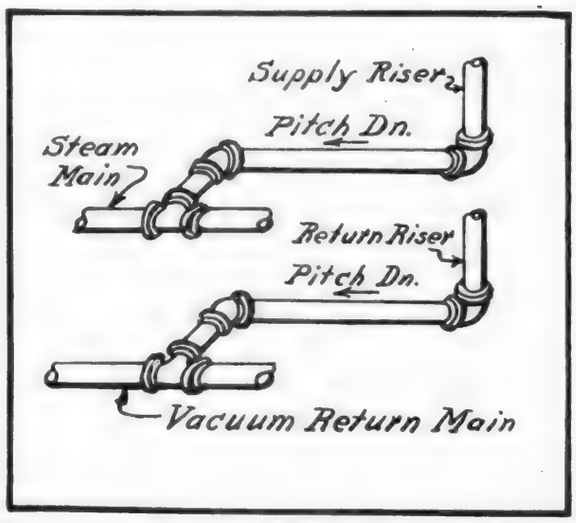


Fig. 49. Simple Form of Runout for Vacuum System Without Shutoff Valves and With a Short Riser

branches and where not the slightest trouble was apparent, but it is not good practice to take chances and most manufacturers of thermostatic traps strongly recommend the use of these cooling branches between the trap and the riser, as detailed in Fig. 51.

Another feature, not to be lost sight of where thermostatic traps are used, is the matter of a dirt and scale pocket at the bottom of the riser; this is simply a small extension of the riser below the tee where the drip line is connected—the extension generally being between 9 in. and 12 in. long—and is for the purpose of catching the dirt and scale from the riser by allowing it to fall into this pocket without entering the trap, where it may cause trouble by getting under the seat of the valve or by clogging the trap inlet.

In the next installment steam mains will be discussed in general; also the dripping of mains for one-pipe gravity steam systems, vapor steam mains and vacuum mains.

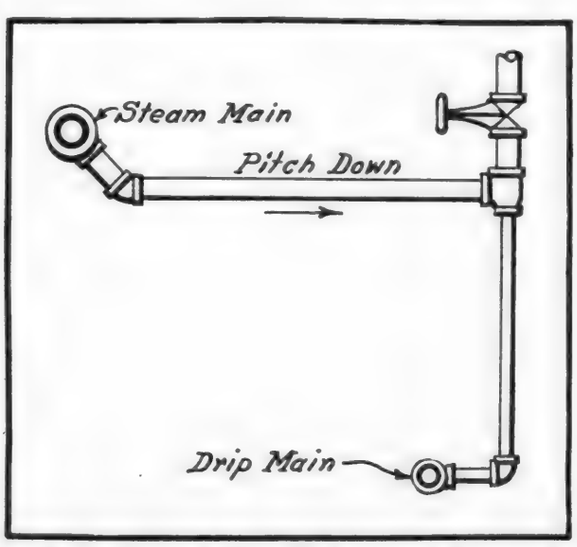


Fig. 50. Method of Dripping Runout of Vacuum System. When High Risers Are Used

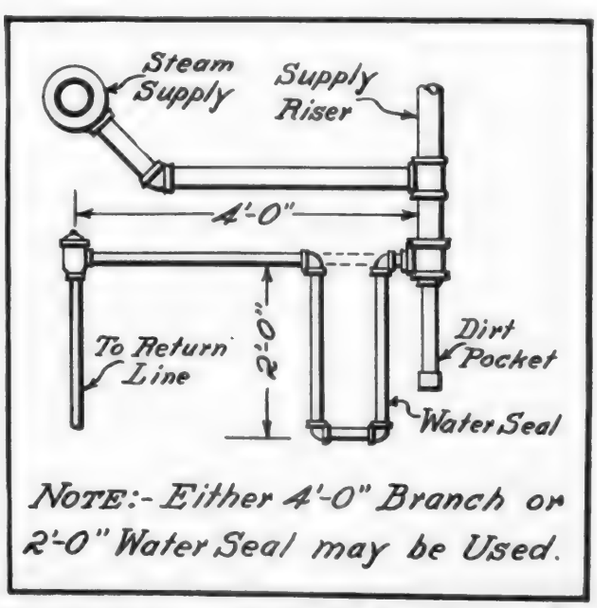


Fig. 51. Arrangement of Cooling Branch Between Trap and Riser in Vacuum Heating System

Design of Lumber Dry Kilns

Part II

By Harold L. Alt

DRYING of lumber and the design of lumber dry kilns has been made the subject of exhaustive study by the Forest Products Laboratory, in the Section of Timber Physics, U. S. Department of Agriculture, and much valuable information has been collected and published by this laboratory.

It is stated that air with 25% relative humidity is considered comparatively dry, while air with 75% relative humidity would be considered as moist. All kinds of wood, if held long enough in an atmosphere of constant temperature and humidity, will come to the same moisture content, and the time required varies with the different kinds of wood.

The simplest way to produce the circulation necessary for drying is by means of chimneys or flues, the natural draft being caused by the temperature in the kiln, which is higher than the outside temperature; there is also a certain amount of inward leakage at the bottom of the kiln and a similar amount of outward leakage at the top of the kiln, no matter how well the kiln may be built. In fact, a reasonable amount of draft can be secured in the chimneys even though no air intakes are provided, but the usual scheme is to provide both chimneys and air intakes so as to aid the natural air flow in every way possible.

In some forms of kiln the air flow is drawn through such a circuitous path, with so much resistance offered to the air flow, that circulation will not start of its own accord and must be assisted by radiators, steam jets or other mechanical means.

VENTILATED COMPARTMENT KILNS

The Forest Products laboratory groups dry kilns into two classes or types—the "progressive" or "continuous" type and the "compartment" or "box" type. As the previous article in this series described a typical kiln of the progressive type, those of the compartment or box type *only* will be considered in this discussion. In Fig. 1 is illustrated a typical cross-section of a compartment kiln which is known as a "ventilated" type. As indicated by the arrows, the air enters through an inlet duct, assisted by steam jets, the inlet duct having suitable openings along its length. The air then passes up and across the heating coils. From the coils the air moves upward into the space provided between the two piles of lumber and then passes outward through the lumber and downward to the openings into the vent chimneys located near the floor.

Not all the air passes up the chimneys, however, part of it returning past the spray line and baffles to the coils where it is again reheated. The down-

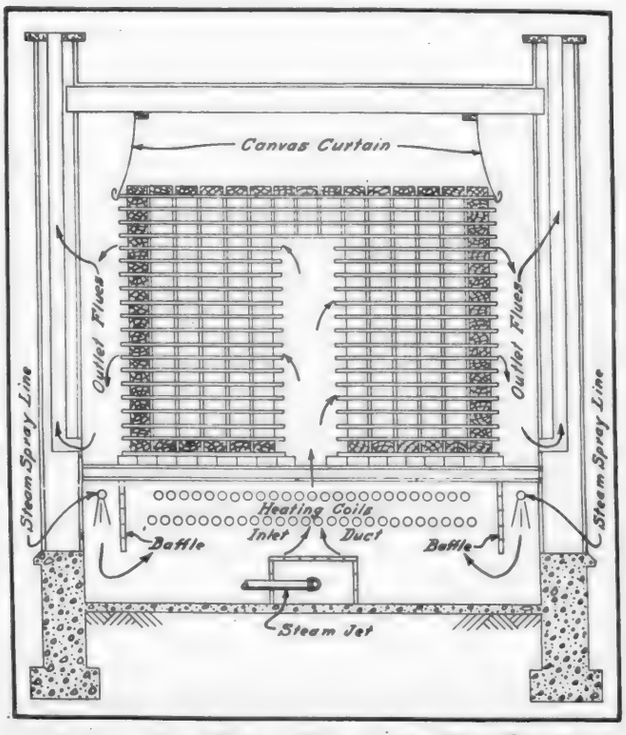


Fig. 1. Typical Cross Section of a "Ventilated" Compartment Kiln

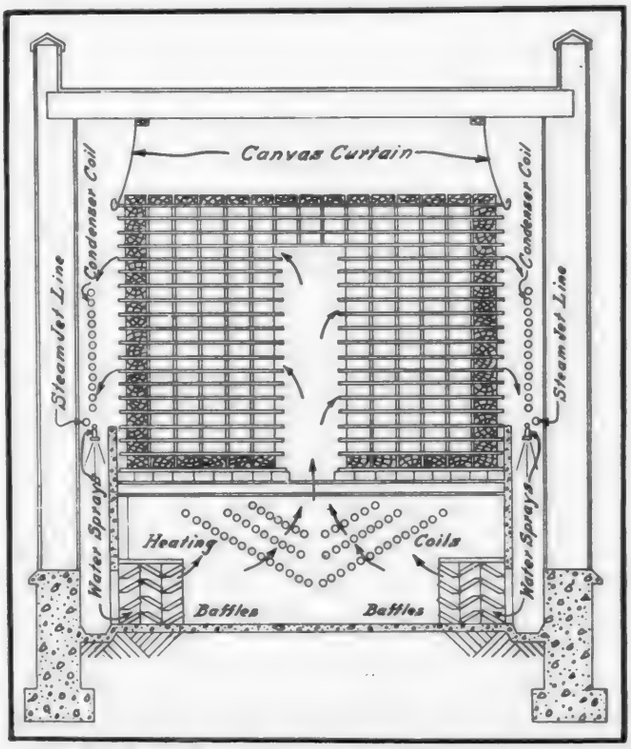


Fig. 2. Water-Spray Compartment Kiln Developed by Forest Products Laboratory

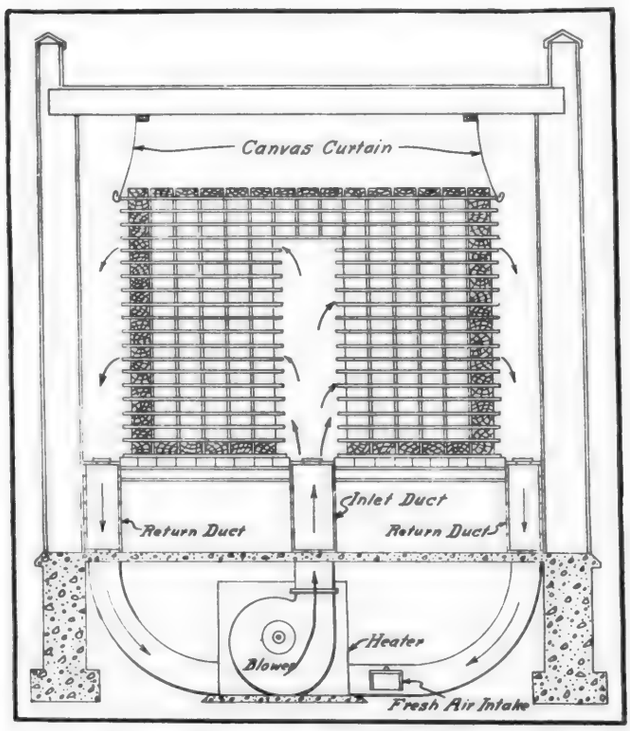


Fig. 3. Usual Arrangement of Fan-Operated Compartment Kiln

ward-pointing steam sprays are used for steaming and high-humidity treatments.

WATER-SPRAY COMPARTMENT KILNS

Another style of compartment kiln is known as the water-spray type; it was invented and developed by the Forest Products Laboratory. It is arranged ordinarily as shown in Fig. 2 and has a circulation similar to that already described in Fig. 1. In addition to the heating coils there are installed two groups of condenser coils through which cold water is circulated. The condensers and the water sprays are located close together and both serve to regulate the humidity and increase the circulation, the sprays and the condenser being used for high and low humidities, respectively. When the sprays are in operation the air is cooled to the dew point each time it passes the circuit, but with the condensers no attempt is made to do this, and condenser water just sufficient to keep the humidity down to the desired point is used.

CONDENSER KILNS

A kiln designed for the use of condensers only need have neither spray nor baffles and the height of the condensers may be varied to suit the individual requirements. The water-spray and condenser kilns require a water supply, as well as a source of heat in order to operate; in the condenser kiln the water is ordinarily run to waste after passing through the coils, but in the water-spray kilns it is usually returned from the spray chambers and recirculated by means of pumps with enough cold water added to bring the temperature down to the desired degree. Humidity in the water-spray kiln, when using the sprays, is controlled by regulating the temperature of the water and, since the air leaving the sprays and passing through the baffles is at its dew point, a recording thermometer is usually placed in the baffles.

FAN-OPERATED KILNS

Circulation in compartment kilns is also obtained in some instances by mechanical means, the same as in progressive kilns and the arrangement is usually along the lines shown in Fig. 3, with the blower set in a small room or housing outside the kiln compartment. Other schemes use a series of small blowers located beneath the compartments and all attached to a single operating shaft running under the entire group of compartments.

With such an arrangement the air flow may also be reversed, as indicated in Fig. 4, which is a typical layout of such a kiln and with the double flow of air indicated by the double-headed arrows. When the fans are run in one direction the air is pushed up into the central chamber and flows through the lumber toward the outside, then down across the heating coils and back to the fan. When the fans are run in the opposite direction the air is drawn down from the central chamber and is discharged across the heating coils, after which it passes up the outside of the lumber piles and through the lumber back to the central chamber.

SUPERHEATED STEAM KILNS

The type of lumber dry kiln, shown in Fig. 5, is known as the superheated steam kiln and is of the compartment classification; it is comparatively simple in construction and operation. Heating

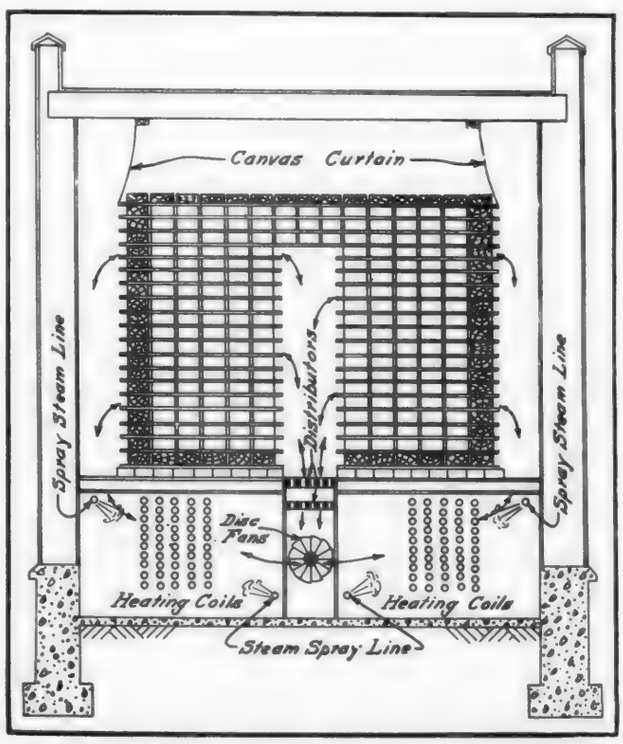


Fig. 4. Another Arrangement of Fan-Operated Compartment Kiln, with Provision for Air Flow

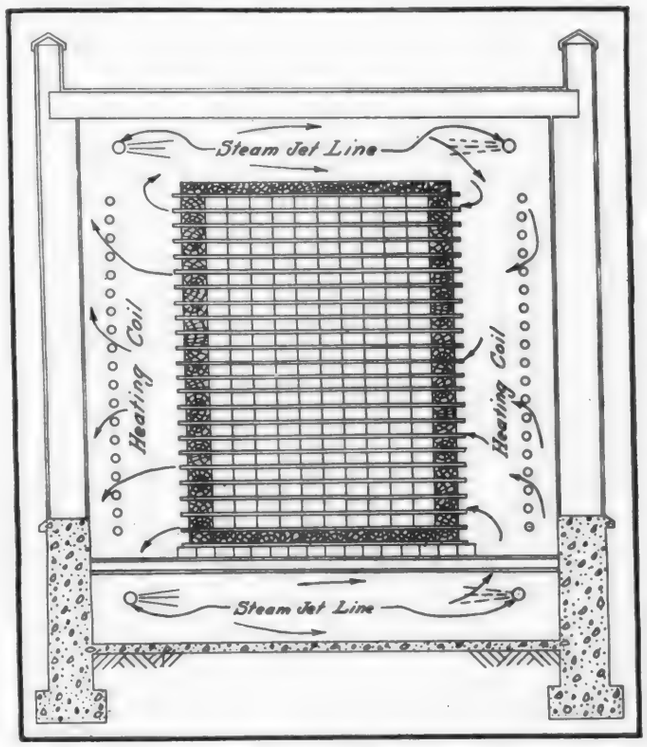


Fig. 5. Superheated Steam Kiln of the Compartment Type

coils on the two sides are arranged for the use of high-pressure steam and jets; it is necessary to reverse the circulation of the air in the kiln periodically and the kiln must contemplate a short travel of the steam through the lumber.

Reversal of the air flow is obtained by setting up a circulation through the use of the steam coils and jets on one side of the kiln only, and then shutting these off, and using the corresponding steam coils and jets on the opposite side. The arrows indicated in Fig. 5 presume the use of the coils and jets on the left-hand side while, if these were cut off and the coils and jets on the right-hand side were turned on, the air flow would be just opposite to the arrows shown.

Economics of Domestic Heating

THE writer applied one of the furnace front door devices in 1906, and used same until 1919 on two different furnaces, with buckwheat coal. The device appeared to make a hotter fire on the surface of the fine coal, and was regarded as a benefit to the furnace, but not as saving a noticeable amount of coal. In 1919 an opportunity offered to try a smoke-pipe air-admission device on a water heater in the writer's residence and this device has been in continuous use during the heating season to date, also with buckwheat coal. The chief benefit of this device appears to be in keeping up better combustion when the draft is checked, this being noticeable at night by higher temperature in the radiators with same apparent consumption of fuel. By way of proving that the benefit is not imaginary, the air admission into the smoke-pipe has occasionally closed for a week during the winter. Under these conditions the house has been harder to heat, requiring different settings of the dampers, and proving in general that the smoke-pipe air admission made a difference in the furnace operation.

There are some conclusions regarding the two classes of secondary air devices that may be made on general principles. *First*, the front-door devices should work equally well on all furnaces, but the smoke-pipe air admission is likely to work well in some furnaces and very poorly in others. Benefit from air admission to the smoke-pipe can come only when the air can flow downward by gravity into the combustion zone. This can occur in some heaters where the flue passages are laid out for a gradual downward flow. In other cases air could not enter the combustion zone without rising upward through flue passages, which seems very improbable.

Secondary air admission is likely to help burn small-size anthracite coal, where there is a deficiency of primary air through the fuel bed. Its benefit with large-size anthracite coal or coke would probably be small. Saving from secondary air admission must be made when the combustion is slow, and when but little fuel is consumed. It can be predicted, therefore, that but little total fuel saving can be made in this way, and this conclusion appears to be confirmed by reliable tests.

One of the little-known facts about heating is the material saving that may be made by the choice of radiator used. The old cast-iron column radiator delivered heat to the room in two ways, *first* by convection to air surrounding the radiator, *second* by radiation giving heat to walls and furniture, thence indirectly heating the air. The difference in the two methods may be stated thus: Convection heats the air hotter than the walls, while radiation heats the walls hotter than the air. Heat loss from the room is dependent upon the temperature of the walls, and the cool wall room will lose heat slower than a warm wall room.

It seems logical to conclude that the heat loss from a room will be a minimum when the radiator gives out all its heat by convection, putting heat into the air first and into the walls second. Radiators have been introduced recently of the complete convection type, consisting of heating surface massed together at the bottom, surmounted by a metal cabinet which acts as a chimney for drawing air through the radiator. Experimental data are now being obtained on the steam consumption of the so-called heat cabinets and standard cast-iron radiators for equal heating effect. Preliminary results appear to show that the heat cabinet, in some cases, has maintained the same temperature at 5 ft. from the floor, with considerably reduced steam consumption, and thus gives promise of some gain in utilization of heat.—*E. H. Lockwood before the Metropolitan Section, A.S.M.E. Fuels Division.*

The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

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Associated Business Papers, Inc.
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VOL. 24 July, 1927 No. 7

Published Monthly at New York, N. Y., by the
HEATING AND VENTILATING MAGAZINE COMPANY

Executive and Editorial Offices, 1123 Broadway, New York.

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BY all odds the most promising effort towards the solution of the low-pressure steam boiler rating problem is embodied in the plan just put forward by a committee representing the American Society of Heating and Ventilating Engineers. To give credit where due, the "maximum heat output" basis, on which the heating contractors' committee has been working, is that adopted by the A.S.H. & V.E. committee. In fact, it may be said that the whole plan, as presented at White Sulphur Springs last month, is acceptable to the Boiler Output Committee of the Heating and Piping Contractors National Association. The importance of this agreement will be realized when it is stated that the heating contractors have not been able to secure the support of a majority of the boiler manufacturers for all the features of their own plan, particularly that part of it which involves the use of "keys" or factors to be applied to those boilers for which complete output test data were not available.

Now that the A.S.H. & V.E. plan has been endorsed by the society, it remains to be seen what the boiler manufacturers will do about it. It is an interesting fact that the society's code gives a prominent place to the limitation of flue-gas temperature. To many this item is considered the crux of the entire problem although, as the report frankly recognizes, "there will be more difficulty in reconciling differences of opinion on the value to be specified for the flue-gas temperature than on any other feature of the proposed code." However, it was in the light of such differences of opinion that the committee decided upon a maximum average temperature of 700° F. for the flue gases.

Some idea of the difficulties involved in reaching an agreement which will be generally acceptable, and of the chaotic conditions now existing in the rating of low-pressure boilers, may be had from the statement that the committee's purpose is limited "to that of permitting comparisons between different boilers on the basis of their ability to take care of the maximum demand." What a commentary on present methods of rating!

In the matter of manufacturers' catalog data, the report favors, as the ideal procedure, the publication of complete test data on each boiler. In lieu of that, the suggestion is made that, under ordinary conditions, it is sufficient to know the maximum capacity of rating, the draft required for the maximum capacity, the efficiency at average normal output and the firing period at average normal output.

Judging both from the personnel of the committee and from the direct and forceful way in which this much-debated subject has been tackled, to say nothing of the support to be expected from the heating contractors, it looks as if at last we are about to get somewhere in removing what has long been a sore spot in the industry. The report, nevertheless, is careful to state that the success of the proposed code "depends on more than its approval by the society in that it must be adopted and used by manufacturers and contractors."

ON another page will be found the first of a series of data sheets on air conditioning. This series will embody practically all of the information required for the design of air-cooling plants, especially of the type used in theatre and similar work. As THE HEATING AND VENTILATING MAGAZINE'S data sheets are no longer printed separately, those desiring the air conditioning series will find it worth while to preserve the sheets as they appear.

AS the present seems to be a time for the breaking of records, aviation and otherwise, THE HEATING AND VENTILATING MAGAZINE may be pardoned for mentioning the fact that the present issue, both with respect to reading and advertising pages, is the largest it has ever published. While modestly acknowledging the confidence which makes this achievement possible, we think it has even a greater significance in reflecting the growth of the industry which, in the space of a few years, has come to be recognized as one which contributes as much to the happiness as to the comfort and health of the community.

Heating and Piping Contractors National Association

Boiler Manufacturers and Heating Contractors in a Jam on Ratings

"Key" System of Indicating Capacities the Stumbling Block. Association Launches National Certified Heating Program

MEETING in its thirty-eighth annual convention, at the unique hotel at West Baden Springs, Ind., June 2-4, members of the Heating and Piping Contractors National Association participated in a program consisting mainly of reports of committees that have been at work since the previous convention, interspersed with extemporaneous talks by guest speakers on subjects of vital interest.

It became increasingly evident, as the convention proceeded, that this group, composed of some four hundred contractors, many of whom were business rivals, found it possible to put aside considerations of industrial competition and get together for analytical and dispassionate study of mutual problems. More than once were differences of opinion aired or conditions in various parts of the country shown to be so dissimilar that it appeared difficult to adopt hard and fast regulations of conduct or practice. But underlying the discussion there was always evident the desire to give and take, to the end that the industry as a whole might gain in solidarity and strength.

Harry M. Hart
Re-elected President of the Heating and Piping Contractors National Association

It is but natural that, out of such a meeting, much constructive work should emerge, and the record of the convention proves the point. The determination to put certified heating before the American public in a nation-wide campaign came as a rather natural result of the enthusiastic reports of local successes that were crystallized in the committee report and at a "certified heating luncheon" that grew into a dinner attended by nearly 20% of the delegates.

It would seem that this movement justifies the heartiest co-operation from every quarter, as it can only be considered as the inside working of this group materially and uniformly to raise the standards of its trade to a high point of excellence, with no ulterior motive or desire for gain. Certain it is that the American property owner will be the greatest beneficiary, and that without materially "paying the price." Had this been the sole output of the convention it would have justified the time, money and effort expended upon the gathering, but it was only one of many constructive attainments.

The report of the committee on a standard text-book for learners appeared to be a divergence from its subject and to swing rapidly into a recommendation providing for the education of apprentices, and the discussion almost immediately veered into a discussion of the relative merits of the "two-man" trade and the apprentice system. It quickly became evident that labor conditions varied so greatly in different parts of the country that, even with a uniformity of purpose on the part of heating contractors, a standard and iron-clad national program would be difficult to attain. When it had become apparent that the problem was beyond the ability of the convention to settle on the floor, the matter wisely was referred to the board of directors, where it can be discussed and analyzed with data available and necessary from sources outside of the association.

The report of the Boiler Output Committee showed conclusively the chaotic condition that obtains in regard to boiler ratings, the earnest desire of the committee to do everything in its power to assist in bringing about a solution, and the unwillingness of some of the boiler manufacturers to fall in with the association's plan for the universal re-rating of low-pressure boilers on a uniform basis. The report, in fact, concluded with rather a scathing arraignment of the advertising of some of the boiler manufacturers and of the obviously meaningless ratings appearing in their catalogs, quoting from advertising copy and catalog nomenclature to emphasize the point. The report outlined the correspondence that had passed between the committee and the National Boiler and Radiator Manufacturers' Association on this subject which brought out the fact that the boiler manu-

facturers, as an association, had definitely declined to accept the "key" system of rating, as proposed by the association.

The committee recommended that the continuation of this work be turned over to a sub-committee of the Committee on Standardization, increased by three members for this purpose, and this action met with the approval of the convention.

The re-election of President Harry M. Hart obviously indicated the desire of the association to take advantage of the high executive ability he has displayed during his term, and to continue along the same lines of endeavor and with the high rate of accomplishment that has marked the period since the last convention. Walter Klie, of Cleveland, whose service as chairman of the board of directors has marked him as one of the most forceful and capable executives in the association, was elected vice-president, and Horace W. Jones, of Rochester, was re-elected treasurer.

An important feature of the convention was the talk on gas heating by Leigh Whitelaw, vice-president of the American Gas Association, and the expressed desire of the association to establish and maintain close relations with the A.G.A.

Another evidence of the increasing co-operation between engineering and trade associations was the appearance on the program of F. C. Houghten, director of the A.S.H. & V.E. Research Laboratory, who outlined the ways in which the funds of the laboratory, which were materially supplemented by the H. & P.C.N.A. at its last convention, were being spent. As the research now being conducted in pipe capacities is of vital importance to the contractors, and as many of the other problems are closely allied to their industry, it was the sense of the meeting that participation in the work of the laboratory would be of increasing value to the association.

Opening Session, June 2

More than three hundred members, guests and ladies gathered in the ballroom of the West Baden Springs Hotel, Thursday morning, June 2, opening the session by singing the national anthem with a vigor that presaged a keen interest in proceedings. President Hart then announced the appointment of the following convention committees:

Auditing Committee: William H. Curtin, New York; Harry Geiser, New Jersey; Leonard G. Kirk, New York.

Credential Committee: Frank S. Spencer, Minnesota; F. A. Clegg, Kentucky; N. W. Lunda, Tennessee.

Association Publicity, Relationship and Improvement: Joseph H. Volk, Wisconsin; R. Calder Beverly, Virginia; Lawrence DeNeile, Missouri; William H. Gottlieb, District of Columbia; Justin A. Keisling, Texas.

Nominating Committee: George M. Getschow, Illinois; Andrew H. Edgar, Pennsylvania; William D. Emery, New York; John W. Partlan, Michigan; H. A. Snow, Massachusetts.

Committee on Resolutions: John P. Baldwin, Illinois; Stewart A. Jellett, Pennsylvania; John E. Rutzler, New York.

In addressing the association Mr. Hart made a strong plea for continued association activities and for more logical thinking where business is concerned. He said, in part:

ADDRESS OF PRESIDENT HART

"If we ask ourselves if trade associations pay, it is like asking the question, 'Does your business pay?' To-day trade associations are such an intimate part of industry that it is difficult to imagine any industry being successful without them.

"Trade associations are now recognized as just as important to industry as the telephone or the telegraph.

"It is hard for me to see why it should be necessary to urge anyone who is engaged in our business to join our National Association, as well as a local association. How can he afford not to belong? I have never met the heating contractor who was entirely satisfied with the conditions of his business, nor have I met one who knew of any way to improve these conditions except through the medium of a strong organization of heating contractors. There *is* no other way, and the sooner the heating contractors of this country recognize this fact, the sooner this business will come into its own.

"When I say a strong organization I don't refer to—simply the *number* of its members, but more especially to the quality of them. That does not mean that we should bar the so-called small operator, because we were all small operators at one time, and we know that small operators sometimes have pretty big ideas.

"I wonder if we ever stop to consider who our greatest competitor is.

"We are very apt to think that some heating contractor who gets a contract that we had expected to get is our real competitor, but I do not think that is correct.

"When we consider this industry from the narrow viewpoint of the awarding of a heating contract, we are doing the industry a great injustice.

"If we are going to make any improvement in our personal business conditions we will have to concentrate on ways and means of improving the entire industry. When we have accomplished this it is bound to be reflected in our own business, because, if the industry is prosperous and we are a part of the industry it is reasonable for us to expect to receive our share, if we are giving our share.

DEVELOPMENT OF WARM-AIR FURNACE INDUSTRY

"It is not so very long ago that we did not consider the hot-air furnace as a serious competitor, but since the hot-air furnace people have organized themselves into a real national association, they have been making themselves very prominent in the small home heating industry and are now real competitors in that particular field. This demonstrates very clearly the importance of trade associations and what such associations mean to their members.

"Just look at the developments of the past five years! Look at the new types of radiators which are going to present a new problem in rating of radiators. Look at the way the cast-iron boilers have developed new capacities. Could anything be more interesting than trying to find out what a boiler manufacturer really means by the rating he puts on his boiler to-day?

"There is surely much of interest to think about in connection with the heating industry, but I am afraid most of us are doing more dreaming than thinking.

"All of our actions are the result of thought and it is, therefore, quite logical to assume that if we think right we will act right, and if we think wrong probably we will act wrong. And so it is most important that we form the habit of thinking right in connection with our business as well as our eating and sleeping.

"I believe that most of us spend too much time trying to find something to take our minds off our business, when our real need is to find something to make us keep our minds on it.

"Take the average golfer's line of thinking, for instance He sits down to do some real thinking about the best way to land a certain job and his thoughts run something like this:

" 'Now, John Jones is the man who is going to have the real say as to who is to get this heating contract, so I think I had better invite him out to lunch and see if I can't line him up. I wonder if he plays golf. Maybe I could get him to go out with me.

Gosh! but that was a rotten game I played yesterday. Just think of looking up on that putt on the sixth green, and if I had only remembered to follow through on the ninth tee I wouldn't have sliced into that rough. My approach shots were certainly punk. I guess I will have to buy a new mashie'—

and so on. I use this illustration because I happen to be a golfer myself (although very few of my opponents will admit this), so I feel that I can speak from experience.

"And so if I were to suggest a slogan for this association I believe it would be somewhat as follows: 'Let's do more and better thinking.' I am sure that such a slogan would go far in the solving of some of our problems. If it does not improve our business, it will at least improve our game of golf.

"There is a slogan that hangs in the Research Laboratory of the General Motors Company which reads as follows: 'This problem, when solved, will be simple.'

"What a help such a thought is to any one tackling some new or difficult problem.

"And so, my friends, what better message could I leave with you than this:

"'Do more and better thinking, and always remember that these problems, when solved, will be simple.'"

W. J. Gemeny, of Chicago, distributed copies of the report of the Apprenticeship Committee which he then read and said that it was the sense of the committee that its report be considered, section by section, and then voted upon, either by sections or as a whole. The report showed that the committee, although nominally favoring the "two-man trade" idea, had worked out, with great care, a comprehensive plan of training apprentices and of tying up with the Apprenticeship Service Department of the National Trade Extension Bureau for mutual benefit.

It was recommended that a National Joint Apprenticeship Commission be appointed for the general direction and supervision of a national program of work, consisting of three to five members of the Heating and Piping Contractors National Association, three to five journeymen steam-fitters from the United Association of Journeymen Steam-Fitters, and one member representing the public school system. The report then continued in considerable detail with regulations governing apprentices and training to be provided, concluding with a plan for giving nation-wide publicity to the project.

The preamble of the report contained the following:

"The committee unanimously agrees that the steam-fitting trade is a two-man trade, requiring the services of a helper for each journeyman. The committee recognizes that while the helper system prevails throughout the country, in some of the larger cities this system has been replaced by an apprentice system. In communities where the helper system prevails, it is suggested that there be selected a certain number who are particularly fitted as to education, mechanical inclination, physical ability and habits, to become capable and efficient journeymen, the number to be such as the trade can properly absorb, and to be designated by the local joint apprenticeship commission. These young men are to be distinguished from the helpers by the name apprentice. The report of this committee is with special reference to the apprentices who are to become the journeymen mechanics. These learners might be designated by the term 'certified steam-fitters' helpers,' in case that term is preferred to the term apprentice."

The discussion that followed the reading of the report as a whole disclosed wide divergence of opinion on the subject, largely because of the local conditions under which various members were obliged to conduct business. The point also was made that the proposals regarding apprentices would defeat the principle of a "two-man" industry. Messrs. Jellett, of Philadelphia; Walker, of Pittsburgh; Jones, of Rochester; Hay, of Indianapolis; Harrigan, of Detroit; Klie, of Cleveland, and Conner, of Cincinnati, told the story of labor and union conditions in their respective cities, and, at the suggestion of Mr. Hart, the matter was dismissed until the following day, giving the members time to study the report.

M. J. Beirn, of the American Radiator Company, then addressed the convention on the subject: "Deferred Payment Plan for Selling Heating Systems."

CAN AND SHOULD HEATING PLANTS BE SOLD ON TIME PAYMENTS?

"There are from 350,000 to 400,000 homes built in this country every year," said Mr. Beirn, "but there are from fourteen to fifteen million old homes with obsolete or worn-out heating systems that are targets for new business. That is, for every set of plans that comes to you for a bid, there are 40 to 50 jobs that could be developed without bidding." Mr. Beirn then outlined the working of the finance corporations and cited the case of one that had been in business over twenty years, doing a large business in financing heating plants and finding the loss factor, during the 1920-21 period, not above normal. He then told how the heating contractor could build up and profit by this business, getting a fair share of the six billion dollars spent annually on time-payment purchases. He detailed publicity methods and suggested the slogan adopted by the National Trade Extension Bureau, "Ask 'em to Buy."

That the suggestions made in this talk were not new in the heating industry was shown by the discussion, led by Stewart A. Jellett, of Philadelphia, William M. Anderson, of Philadelphia, and R. B. Miller, of New York. Each brought out a new angle to the problem, and the general view was that such business is not all carried on in a bower of roses. The variation of laws in different States, of course, is the principal difficulty.

Following this discussion Samuel R. Lewis, chairman of the Committee on Research of the American Society of Heating and Ventilating Engineers, told of the work of his committee and also reported that the labors of the A.S.H. & V.E. committee, designated to formulate a code for the rating of low-pressure boilers, had been completed, studied by the council on the previous day, and would be presented at the convention in White Sulphur Springs. Mr. Lewis also outlined the tests on window infiltration now in progress in St. Louis, the co-operative work to be carried on in various technical-school laboratories supplementing those of the Research Laboratory and, what appealed more to his listeners, the studies in pipe capacities now well under way at Pittsburgh. Mr. Lewis left the platform with a unanimous vote of thanks to himself and the society he represented.

Morning Session, June 3

Walter Klie opened the Friday morning session with the report of the board of directors in which he briefly outlined the matters that had occupied the various meetings of the board and sketched the more important problems now confronting it. Mr. Klie said, in part:

REPORT OF BOARD OF DIRECTORS

Walter Klie
Chairman, Board of Directors

"Four meetings of your board of directors were held during the year. They were very well attended and the three meetings in New York, which occupied two full days each, were filled with the most earnest and intensive study of the problems of the association, as they were brought to us through the various committees above referred to, by individuals and by the constructive thought of the members of the board itself.

"At one meeting considerable discussion was indulged in regarding the handicap that was being placed upon the Boiler Output Committee by the failure of some boiler manufacturers to give the committee the necessary data, and it was voted that it is the consensus of opinion of the board of directors that the Boiler Output Committee should continue its work, and that it should prepare for distribution to members of the national association what, in the opinion of the committee, constitutes a proper load for operation on various low-pressure and hot water heating boilers; this to be based on performance charts submitted by boiler manufac-

turers in accordance with our standard 'Boiler Formula and Procedure of Tests with Charts for Low-Pressure Heating Boilers.' Where such performance charts have not been furnished by the boiler manufacturers, this information to be based on such information as the committee is able to secure."

The report of the treasurer, made by H. W. Jones, was brief but encouraging. He showed that the net assets of the association are now over $40,000, an increase of 25% over the assets of a year ago. The auditing committee followed with a certification as to the correctness of the accounts.

SECRETARY'S REPORT

Mr. Gombers opened his report with a plea for continued and increasing co-operation on the part of the members and for such publicity within the association as would give the individual members a better appreciation of the full scope of association activities.

Mr. Gombers recalled the fact that, thirty years ago, the association was in debt and had an active membership of about two hundred, while to-day the membership is nearly a thousand and the association has resources of about $40,000. He concluded with an appreciation for the expressions of felicitation that were received to mark his thirty-five years of service as secretary.

The report of the Apprenticeship Committee, having been brought forward again from the previous session, there was a brief discussion, following which it was referred to the board of directors, as was the matter of the text book now being prepared by the Trade Extension Bureau.

The Membership Committee report was read by Mr. Gombers for H. A. Snow, chairman. In it was outlined the procedure evolved for increasing membership through the activities of eight zone chairmen and the staff at national headquarters. The efficacy of this system was indicated by the report that 120 members had been added to the association's roll since the last convention.

The committee reported that members of the staff at headquarters had visited 53 cities during the year, and that new local associations had been formed in Baltimore, Dayton, and Youngstown, Ohio, while active work in forming or enlarging locals was going on in Richmond, Norfolk, Utica, Westchester County, New York, and Sheyboygan, Wis.

Mr. Hart then introduced Leigh Whitelaw, vice-president of the American Gas Association, who addressed the convention on the subject of domestic gas heating.

GAS HEATING INTERESTS CONTRACTORS

Mr. Whitelaw briefly outlined the reasons for the tremendous increase in domestic heating with gas during the last year or two and expressed his belief that other forms of using natural fuels, by comparison, were wasteful. He predicted universal acceptance of gas, both manufactured and natural, for this purpose and said that even the high rates per unit of gas, or of heat, would not prevent the use of gas because of its adaptability to automatic firing and control, the absence of noise, and the general cleanliness attending its use.

A general discussion followed, the tenor of which indicated a desire on the part of heating contractors to keep advised of progress in this field.

The report of the Committee on Trade Relations was read by Walter Klie, in the absence of George Mehring, chairman. Mr. Klie told of the very happy relations that had been formed with many of the agencies, industries and individuals engaged in overlapping activities. He told of the campaign in Chicago for increasing the use of gas, and said that in that city more gas-fired boilers had been sold in the last twelve months than during the previous fifteen years. He cited the careful working out of co-operative plans so that the gas company, the heating contractor and the owner were mutually protected and satisfied. A spirited discussion was led by Stewart A. Jellett, Philadelphia, C. W. Stanton, New York, W. L. Fleisher, New York, and Fred Stiller, Minneapolis.

In making a report of the Secretaries Conference, L. T. Braun, chairman, suggested the employment of a field representative and recommended that he maintain contact with the American Gas Association in regard to gas-boiler sales and installation.

DIRECTOR HOUGHTEN TELLS OF RESEARCH LABORATORY

Introduced by President Hart, F. C. Houghten, director of the A.S.H. & V.E. Research Laboratory, then described the principal lines of research now under way at the laboratory in Pittsburgh. In particular he told the convention of the study being made of the capacities of pipe sizes, showing, with lantern slides, the set-up of apparatus and graphs of preliminary results obtained. He also outlined the studies being made at St. Louis to determine infiltration through metal windows. At the conclusion of his talk Mr. Houghten was given a unanimous vote of thanks.

Boiler Output Committee's Report

George M. Getschow
Chairman, Boiler Output Committee

George M. Getschow, chairman of the Boiler Output Committee, presented the report showing that his committee had labored through a very discouraging year, due, apparently, to frank opposition on the part of the National Boiler and Radiator Manufacturers' Association. Mr. Getschow said, in part:

"The Boiler Output Committee came into existence at the thirty-fifth annual convention to solve, for our members, if possible, the very complex and confused question of boiler ratings. During the first year we apparently made very good progress with the assistance of an advisory committee of boiler manufacturers.

"There was prepared during the first year, diagrams, formula and standard form of output tests for heating boilers and the same was submitted to twenty-two of the largest manufacturers of low-pressure heating boilers. After they had carefully analyzed the same, they assured your committee that they would adopt the diagrams and standard form of output tests and give us the information asked for on our charts and diagrams.

"The committee then reported the standard form of output test for heating boilers to our members at the thirty-sixth annual convention and the same was concurred in and adopted.

"During the year following our thirty-sixth annual convention, your committee distributed charts, diagrams and formula to thirty-four house-heating boiler manufacturers, and received from five different manufacturers about eighty-five output test charts.

"The committee, during this period, also prepared a code for formula by which a proper boiler could be selected from the manufacturers' test charts, and numerous meetings took place with the advisory committee of the manufacturers on this division of our work.

"At our thirty-seventh annual convention, your committee submitted their report on the progress made. Included as part of this report was the tentative formula for selecting the proper boiler from manufacturers' certified test output charts. This was concurred in and adopted, and the committee continued with power to revise said formula from time to time as necessary.

"Shortly after our convention in 1926, your committee again made efforts to confer with the boiler manufacturers through their secretary and advisory committee but without any degree of success, which for several months left the committee in a quandary as to what to do under the circumstances."

TEXT OF BOILER MANUFACTURERS' RESOLUTION

"Subsequently we were advised of a meeting of the National Boiler and Radiator Manufacturers' Association, held on September 24, 1926, at which a resolution was unanimously passed containing the following:

" 'The National Boiler and Radiator Manufacturers' Association places itself squarely on record as opposed to the "key" system as at present applied and, therefore, instructs its Output Committee to cease its activity in an advisory capacity with the Boiler Output Committee of the Heating and Piping Contractors National Association.'

"With this resolution and information before them, your committee could very readily understand the reason why boiler manufacturers, particularly members of the manufacturers' association, were not submitting any more boiler output test charts."

Mr. Getschow then told of an extended correspondence that had ensued between attorneys for the two associations, the National Boiler and Radiator Manufacturers' Association urging that joint submission be made to the Department of Justice regarding the legality of the "key" system as now practiced and potentially to be applied by the Heating and Piping Contractors National Association.

The committee signified the willingness of the association for "jointly submitting this question to the Department of Justice, provided that a statement of the facts can be agreed upon, and this statement of facts submitted solely for the purpose of obtaining the point of view of the Department of Justice upon any legal question involved."

The report then continued:

"During this possible procedure, which at best will consume considerable time, we believe it entirely proper that the work on boiler standards be pushed forward to completion as early as possible.

"Your committee is of the opinion that our members are looking to our association for information from time to time for the advancement and improvement of the industry, and recommendations made that will assist them to accomplish this will be generally accepted, particularly if such recommendations pertain to assisting them along standardization lines which they are unable to obtain through any other channel.

"The particular question which is of great interest to our members is the matter of correct information on boiler output from a standard method of test and a standard method of selection of the proper boiler for various heating installations which they are called upon and obliged to guarantee.

"This information is what your committee has been attempting to give you for the past three years but have not received the co-operation of some of the boiler manufacturers, particularly during the past year, and this will make it impossible to give the information in the manner intended.

"Some boiler manufacturers have not given any assistance to the committee during the past year and have further confused the question by changing their ratings from time to time. Also boiler manufacturers are publishing boiler ratings in many different forms, such as the following:

1. Output.
2. Guaranteed boiler loads.
3. Net loads.
4. Net rating.
5. Capacity square feet, direct cast-iron radiator loads, square feet.
6. Ratings, square feet, with high efficiency and high output.
7. Original rating, square feet.
8. (A) Output rating, 10-hour firing period.
   (B) Commercial rating.
9. Comparative rating, square feet.
10. Our rating, commercial rating.
11. Guaranteed radiation loads, square feet.
12. Actual capacity, square feet, current rating, square feet.
13. Comparative rating, 12-year old catalogue rating

and many others too numerous to mention."

Mr. Getschow then quoted at length from the advertising matter of a boiler manufacturer, the "copy" being characterized as misleading and confusing, both to the public and to the heating contractor.

The report then continued:

"The committee does not desire, however, in any way to appear as criticizing the boiler manufacturers, but does wish to place before our members, the facts and conditions that have and are still confusing our members in selecting the proper boiler for their heating installations which they are obliged to guarantee.

"It is very evident, therefore, to the committee, that, due solely to their own course of conduct, the boiler manufacturers are entirely to blame for the practice of the so-called keying of boilers, which has extended to many cities since our thirty-seventh annual convention. Our members have been expecting some information from this committee on boiler output. But the delay and added confusion before mentioned has caused locals to adopt methods of placing factors on heating boilers based on their experiences and from the best information obtainable.

"The factors adopted on heating boilers by locals have been of great assistance to their members in the fulfillment of the guarantee they are called upon to make to their clients—the consuming public. Isolated members also have been greatly benefited thereby.

"The committee, therefore, is confronted with this problem. Some boiler manufacturers will not co-operate and give us the information asked for; yet our members are asking for information on boiler performances either in the form of boiler output on our charts or by some other method.

"Your committee is, therefore, of the opinion that there should be prepared, standards on heating boilers from the best information and data obtainable, either from the boiler output test charts, if submitted, or from such other information and data obtainable. These standards to be recommended to our members for the general average conditions for heating installations.

"We are further of the opinion and recommend, that this work be carried on and completed by the Committee on Standardization and further recommend that the Committee on Standardization be increased from six to nine members in order that a sub-committee can be named which will undertake and complete the boiler standards. We further recommend that the Committee on Standardization proceed as early as possible to prepare their recommendations, and, on completion, that the same be printed and distributed to our members."

PIPE SIZE CONCLUSIONS OF RESEARCH LABORATORY ACCEPTABLE TO COMMITTEE ON STANDARDIZATION

Walter L. Fleisher
Chairman, Committee on Standardization

Walter L. Fleisher then presented the report of the Committee on Standardization, of which he is chairman. He said, in part:

"The general subject of the year's work was pipe sizes for low-pressure steam heating systems, with particular regard to critical velocities. This subject was very carefully investigated with the assistance of F. C. Houghten, director of the Research Laboratory at Pittsburgh, and the results obtained were carefully analyzed by the committee, and the conclusions and findings now form Part 3 of the Engineering Standards of the Association.

"Your committee has also bent every effort to have the engineering standards for figuring radiation accepted as a basis by all local associations; the calculations and charts having stood the test of time and having been practically accepted by all authorities and all associations throughout the country, we felt it was only just and proper that local associations who were actually using the details of methods and charts presented by the Committee on Standardization should, at least, agree to accept them as a standard and to abide by the results obtained in case of dispute or arbitration. This, we feel, has been generally done, and is the biggest step forward that has been accomplished by your Committee on Standardization this year.

"Having satisfactorily settled the question of roughing-in dimensions of radiator valves, both supply and return, your committee is undertaking the roughing-in standards for the new types of radiators now coming on the market. This work is in progress and the new committee should be able to bring it to a satisfactory conclusion some time next year.

"Your committee has presented to the Research Laboratory in Pittsburgh a number of problems which they have evolved from the work which they have been doing, the satisfactory answering of which should be of great value to the association. These problems relate principally to the effect of the time period and its effect on transmission through various types of material."

The report of the Committee on Certified Heating was presented by Herbert A. Snow of Boston, chairman of the committee.

Certified Heating Sponsored by National Association

Adoption of Committee Report to Be Followed by Nation-Wide Campaign to Extend Practice Already Well Developed by Several Local Organizations

H. A. Snow,
Chairman, Committee on Certified Heating

ADOPTION of the report of the Committee on Certified Heating of the Heating and Piping Contractors National Association, at the West Baden convention, initiates this admirable movement on a country-wide scale, directed and sponsored by the association. The success that has attended the experiences of several of the local associations, some extending back as far as ten years, convinced the committee that the time was ripe for extending certified heating under control and supervision of the national association, so that the greatest possible benefits might accrue.

The labors of the Certified Heating Committee under the chairmanship of H. A. Snow, of Boston, appointed last fall, have been to the point, and the report is exemplary in its terseness and coverage of all important points with specific recommendations. The essence of the report follows:

This committee, consisting of three contractor members and three local association managers, held two meetings, the first in December, when two days were devoted to a survey and the preparation of preliminary recommendations, and again in March, when three full days were given to a study of detailed plans. Each of these meetings preceded a directors' meeting at which our recommendations were considered and approved.

A summary of these recommendations which have been made by the committee and approved by the directors is herewith presented.

First. A survey made in November, 1926, showed that Certified Heating was operating or about to be established in eleven cities throughout the country. At least one-half of our national membership was thus included in the plan.

Second. In view of this fact and considering that Certified Heating had been in successful operation over a period of at least ten years, it was recommended that Certified Heating be now definitely recognized by our national association.

Third. Such recognition has already taken definite form through:

A. The establishment of general principles of Certified Heating,
B. The adoption of a slogan and insignia,
C. The legal protection for use of the slogan and insignia.
D. The preparation of a form of agreement between the national association and local associations, including forms for Certified Heating Certificate and Certified Heating Supplement,
E. The publication of pamphlets for the guidance of local associations, association managers, and for the general spread of knowledge to all who should become interested in Certified Heating.

In order that you may realize the true significance of these various forms of recognition we offer the following brief statements in explanation.

A. GENERAL PRINCIPLES. We believe that the experience of the past few years warrants us in stating that the observance of these principles is fundamental to the successful initiation or continuance of Certified Heating by local associations. Nothing can or should be done as a national association to make the adoption of these principles mandatory. Guidance based upon experience is the boon which the national association offers to its members. It is co-operation in its finest sense, because to succeed, it must be of real benefit to the members, to the organizations, and to the public whom they serve.

We wish to place these principles upon record by including them here as a part of our report:

First. That there should be a separate organization of those engaged in the heating and piping industry.

Second. That there be employed a full-time executive.

Third. That the local associations should secure from the national association permission for the use of the slogan and insignia in their particular locality.

Fourth. That engineering standards be adopted covering at least radiator sizes, boiler selection data and one-pipe system pipe sizes, and that, as far as possible, these standards shall agree with those of the national association.

Fifth. That the use of Certified Heating be restricted to certain definite types of building construction.

Sixth. That the slogan and insignia be used by each member on their proposals for work and on the installations when completed.

Seventh. That adequate methods of plan and data checking, inspection of work and issuance of certificate to owner, be adopted.

Eighth. That there should be preliminary conferences with architects and engineers before putting plan into operation to secure the greatest extent of co-operation.

Ninth. That suitable and constant publicity be given to the general principles and advantages to owners and builders of Certified Heating.

B. SLOGAN AND INSIGNIA. A Certified Heating program cannot be complete without a slogan and insignia.

The slogan and insignia adopted are not perfect, but it seems to us that they cover the essential features, both as to

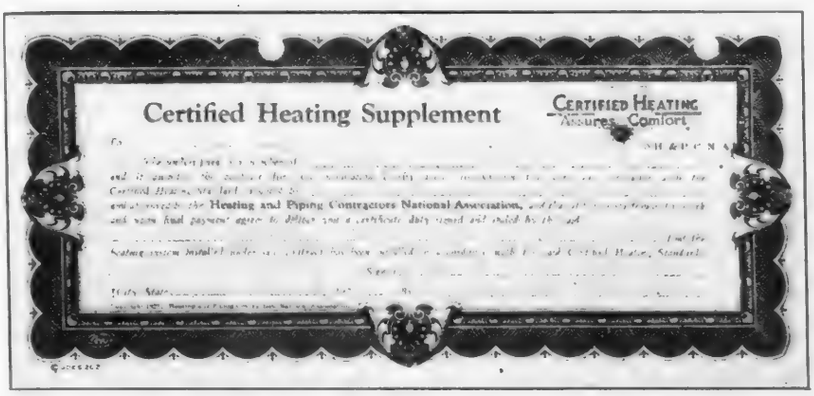
The Mark of Certified Heating Adopted by the Heating and Piping Contractors National Association

their practical use by the individual contractor and by the national association in its effort to retain for its members every benefit such a program offers, as well as a legal protection against its improper use.

C. We submit herewith the slogan and insignia as adopted and as now in the process of complete legal protection.

The arrangement for the copyright privileges and other appropriate protection are being made by counsel for the National Association.

D. AGREEMENT. In order that the proper protection might be secured to our members, it is desirable that the use of the Certified Heating slogan and insignia, shall be through an agreement between the national association and the local association. The agreement provides that the adoption by the local association of certain standards which have been submitted to and approved by the national association shall entitle the local to full use of the slogan and insignia, including the Certified Heating Supplement to be sent with each bid, the plate to be attached to the boiler, and the Certified Heating Certificate to be


Certified Heating Supplement

CERTIFIED HEATING Assures Comfort

"Rider" to be Attached to Any Bid Under Which Contract Will be Carried Out in Conformance with Certified Heating Standards

issued on completion to the owner. Provision is made whereby the license to use the slogan and insignia may be revoked.

We believe that the inclusion of the national association as an integral part of the local Certified Heating program strengthens that local and its members in their standing before the community and gives to the entire movement a power that it could not hope to obtain in any other way.

E. PUBLICATIONS. To put Certified Heating before the public in such a way as to create a real demand presents an interesting problem.

We felt that it first must be sold to our own membership, hence our first publication was sent out in April and was called "A Program for Establishing Certified Heating." That pamphlet will be available for such further distribution as may be necessary or desirable.

Inquiries received at our national association headquarters, regarding Certified Heating have become so numerous that it is evident that detailed information must be prepared for the especial use of association managers. A "Manual for Association Executives," put out in loose-leaf form, has now been printed and will be furnished to such associations as are licensed under agreement already described. As further information is available it will be printed and sent to managers to be added to the manual in a similar manner to our National Association Engineering standards.

How shall we put Certified Heating before the architects, builders and the general public?

Your committee was advised to follow the lead of the Chicago association, whose publicity campaigns have had such marked success. We have made arrangements whereby Buckley, Dement and Company, of Chicago, are to prepare a series of pamphlets using, with the permission of the Chicago association, material and cuts already in existence and prepared especially for their use. It is planned that the first of these will be ready about September 1, to be followed at stated periods by other pamphlets attractively prepared, each telling the story of Certified Heating.

The action of our national board of directors, in approving and adopting our recommendations, has made it possible for this report to be one of definite accomplishment, rather than one simply of suggestions. We feel that such approval by the directors warrants the enthusiastic support of our national membership and that those here assembled should so express themselves by suitable resolution.

A matter which the committee has given careful consideration to is the employment by the national association of a field representative.

Your committee believes that the possibilities of increase in national membership, through Certified Heating, are of sufficient promise to justify the employment of such a representative and we have so recommended to the directors.

The discussion that followed the report indicated enthusiastic endorsement of the plan and acceptance by practically every local association.

Morning Session, June 4

The last session opened with a paper by W. K. Glen, on the work of the National Trade Extension Bureau, in which he outlined the activities of his organization and what it was attempting to do along lines of interest to the heating contractor.

H. E. Wetzell, engineer for Smith & Oby, of Cleveland, then presented to the meeting a résumé of the present status of pipe welding as applied to work that might be carried out by heating contractors. With blackboard sketches and graphs he showed how pipe of different sizes and for different purposes was welded, the costs and advantages and results obtained. His experience indicated that pipe above 3-in. diameter could economically be welded, as a general proposition, but that for smaller sizes pipe fittings were cheaper and more satisfactory. This paper proved rather an eye-opener to many of the contractors in view of the possibilities of future development in their lines of work.

President Hart then introduced Secretary Herendeen of the National Boiler and Radiator Manufacturers' Association. Mr. Herendeen, in a brief talk, told the convention that the problem of boiler ratings, referred to by Mr. Getschow in his committee report on the previous day, would receive the attention and co-operation of his association.

The endeavors of the National Trade Extension Bureau to work with the Heating and Piping Contractors National Association to the end that the latter might expand and secure its proportionate share of the tremendous expenditures of the American people was the subject of a talk by W. G. Bergner, secretary-manager of the bureau. He told of the formation of a heating department in the bureau and said that its efforts would be largely directed toward assisting the heating contractors to appreciate and to secure the almost unlimited business that is at their doors.

Stewart A. Jellett reported for the Lien Law Committee, telling of the

Facsimile of Plate to Be Attached to Boiler Under Certified Heating Plan

Certificate

FOR CERTIFIED HEATING INSTALLATION

Certificate Sent to Owner, on Completion of Contract, by the National Association

probability that, through the influence of Secretary Hoover, a uniform and satisfactory law soon would be in force.

J. P. Baldwin, chairman of the Resolutions Committee, presented the following resolutions, which unanimously were passed:

"WHEREAS, It is often desirable to have a tapped opening immediately over the water-line of boiler to be used as a surface blow-off and tapped openings in bottom of boiler, conveniently located to facilitate thorough cleaning of boiler, therefore be it

"RESOLVED, That we respectfully request our board of directors to present this matter to the boiler manufacturers for their attention.

"RESOLVED, That notwithstanding the fact that this association has often publicly expressed itself on the subject, still it is of sufficient importance to the welfare of our industry, that we again reaffirm such policy namely; that steamfitting is essentially a two-man trade, requiring the services of one helper for each steamfitter employed at such work.

"RESOLVED, That this association favors the reduction of the income tax on corporations to the lowest point possible, consistent with sound financing, and that we favor abolishing of the tax on inheritances."

Several resolutions were of thanks and appreciation to the officers and committee chairmen; to the Chicago Master Steam Fitters' Association, for co-operation with the Certified Heating Committee; to the National Trade Extension Bureau; to the manufacturers and supply men, the trade press, and the management and employees of the West Baden Springs Hotel for their part in making the convention a success, and to M. J. Beirn, Samuel R. Lewis, Leigh Whitelaw, F. C. Houghten, H. E. Wetzell, W. K. Glen and William G. Bergner for their addresses before the convention.

OFFICERS ELECTED

Secretary Gombers then was instructed to cast one ballot for the election of the following officers, named by the nominating committee: Harry M. Hart, president; Walter Klie, vice-president; H. W. Jones, treasurer; Harry M. Hart, William Anderson and H. W. Jones, directors.

Stewart A. Jellett, in the chair, then called upon the new officers for brief talks, after which the convention was declared adjourned.

GOLF, BOWLING AND CARDS OCCUPY AFTERNOON

After a late luncheon Thursday, June 2, the party was broken up according to individual inclinations. The golfers divided between the upper course at French Lick, only a mile away and a very sporty hill-top course above the West Baden Springs Hotel. Those who knew how to mount a horse found an excellent stable operated by the hotel and enjoyed the bridle paths through the beautiful rugged countryside. The ladies adjourned to the Hoosier Club where cards and bowling were later deserted for tea.

Sixty-eight players entered the golf tournament and the first prize for low net, which was a handsome leather golf bag, went to S. L. Haas, of Chicago, while the second and third prizes were won by S. E. Fenstermaker, of Indianapolis, and John Usher, of Chicago, respectively.

The winner of the ladies' golf tournament was Mrs. J. A. Cook of Chicago, with Mrs. Ben Stevenson, Jr., runner up.

Ben Stevenson was in charge of the men's tournament, and J. B. Garfield "bossed" the ladies.

Convention Sidelights

IN these days of great national conventions and organized travel, it is but part of the program that special trains gather the delegates from the larger centers and convey them, with the comforts of the modern train de luxe, to the common destination. A special train, running as the first section of the American, of the Pennsylvania Railroad, left New York on Monday evening, May 31, for West Baden Springs, carrying the New England members and adding the Philadelphia, Camden, and Pittsburgh delegates en route. Club and observation cars added to the comforts of the train and the dining car service announced a special menu. About 75 members and guests took advantage of this train, which arrived at West Baden just ahead of a similar special from Chicago, carrying nearly 150 passengers.

The arrivals from the East were unprepared to find flood conditions at West Baden, as floods to them had meant only first-page stories in the daily papers and contributions to the sufferers in the Mississippi Valley. As the train pulled into the station it appeared that the hotel was perched on a plateau on the shores of a pretty lake, and when it was learned that the lake occupied the greater part of the lower golf course it was suggested that West Baden golf consisted in dropping a ball into a boat and counting "strokes" (of the oars) required to cross the lake.

The fine roads of the Middle-West robbed the railroads of many fares, as cars from every State in that section were parked on the hotel drives.

On Wednesday morning there were simultaneous meetings of the board of governors of the association and the council of the American Society of Heating and Ventilating Engineers, each lasting until the dinner hour. The former was presided over by Walter Klie, chairman, and the latter by President F. Paul Anderson.

PRE-CONVENTION EVENTS

Shortly after the arrival of the special trains the "Old Guard"—past-presidents of the association—gathered for the annual dinner at which Stewart A. Jellett presided. "Guardsmen" present were: Edwin P. Ambler, Jr., Joseph F. Gunn, and John T. Bradley, St. Louis; M. Loring Danforth, Buffalo; George M. Getschow, Chicago; Stewart A. Jellett, Philadelphia; J. E. Rutzler, New York; Joseph H. Volk, Milwaukee; Julius A. Ziesse, Grand Rapids; W. G. LeCompte and Henry B. Gombers, New York.

The evening was devoted to a get-together party in the atrium for which the hotel orchestra provided music. The "stunt" of the evening was a competition between local "old fiddlers" headed by W. D. Elmore, who, winning the national contest held last year under the auspices of Henry Ford, in Detroit, is known as the national champion fiddler.

Local talent also provided a barn dance, the leader being widely known for his vocabulary in calling the figures. These specialties earned the hearty applause of blasé visitors from the big cities.

THE DINNER DANCE

Instead of holding a formal banquet, Thursday evening was devoted to a dinner dance, tables for nearly five hundred being set in the beautiful atrium or circular covered court around which the hotel is built. This glass-covered room, about 400 ft. in diameter and six floors high, was decorated with palms and ferns, and lighted, not too brilliantly, from the top. During the progress of the dinner an excellent orchestra played and introduced several musical novelties that caught the fancy of the crowd. Two popular melodies were played with bell ringers scattered on the many balconies around the atrium. Each ringer had a pair of bells of a single tone, and the skill displayed in accurately synchronizing with the orchestra was warmly applauded. The entertainment committee circulated through the atrium distributing favors, decorative and noise-making, and, in a cleared space at one side, dancing was continuous. Informality was a pleasing feature of the evening.

THE "CERTIFIED HEATING LUNCHEON"

It had been intended to hold a "Certified Heating Luncheon" but the unexpected interest in the subject made it desirable to substitute a dinner. Seventy-five delegates gathered around the tables in the Pompeian Room and, stimulated by the presentation of the subject by Herbert A. Snow and the leaders of the isolated Certified Heating groups which had brought it to the present stage, L. T. Brown of Chicago; G. W. Stanton, of New York; M. J. Chagnard, of Louisville; George L.

Rood, of Chicago; A. R. Herske, of Cleveland; Thomas Gale, of St. Louis, and others, chipped in bits of history and experience.

It was brought out that the heating contractor operating as a member of a local association, with the national association at his back, was in a much better position to secure and handle worth-while contracts than the unattached contractor. The ability to install a heating plant with the designation "Certified Heating" was another valuable asset, and the consensus of opinion was that the time had now come for the national association to assume the leadership and weld the member contractors of the whole country into a unit in providing superior plants that could be guaranteed.

The dinner was an unqualified success and added materially to the knowledge of many contractors who had not a working knowledge of the plan.

After luncheon a party of 135 delegates took cars to Marengo Cave, one of the natural wonders of the limestone region in which West Baden is located. The party returned late, tired and soiled, but unanimous in admiration of the beauties and marvelous structure created so far beneath the surface of Mother Earth. The evening was devoted to cards and dancing in the atrium.

American Welding Society Hears about Pipe Stresses

"Stresses in Large Pipe Lines" was the subject on which Prof. L. T. Jones, of the University of California, addressed the American Welding Society at the meeting held in the Engineering Societies Building, May 17.

The paper was confined to the experiments made and the results arrived at as a result of the investigations carried out on the big steel water conduit being constructed to bring an adequate water supply to the cities lying on the east shore of San Francisco Bay, including Berkeley and Oakland. This steel line is a trifle over 5 ft. in diameter and will ultimately extend back into the country a total distance of ninety miles of which about forty miles so far have been installed.

The pipe was shipped out to the west coast with the longitudinal seams welded, and after arrival was dropped into a ditch about 10 ft. deep and the circumferential joints then were welded by gas. As the work progressed difficulty was caused by the circumferential joints parting or cracking open from time to time. Finally the engineers in charge decided to permit no more welding and to use the riveted joint instead. This meant considerable added expense and so a thorough examination was made by Professor Jones and his associate, Professor Weeks, to determine the causes of the rupture of the joints. Ways and means to overcome this undesirable feature were also considered.

Professor Jones explained the various stresses set up in a long pipe line and illustrated some of his points with slides and diagrams. The chief cause of the trouble, stated Professor Jones, lay in the temperature stresses caused by welding joints during the hottest part of the 24 hours when the top of the pipe was at a temperature considerably higher than the bottom, which caused a lengthening of the entire line. When the pipe cooled down at night to a temperature almost equal on both top and bottom, there was a shortening of the entire line which produced tensile stresses that the welded joint was not able to withstand.

Another feature which aggravated the matter was the using of a welding steel which did not have a carbon content of 0.10% after being deposited. The paper brought out the fact that it was not the chemical composition of the welding steel before welding, so much as it was the condition of the welding material after being deposited on the joint, which made the difference between a strong joint and a weak one.

The remedies for eliminating the failure of welded joints under such conditions of installation as suggested in the paper were to do the work during the portions of the 24 hours when the temperatures of the top and the bottom of the pipe would be nearly equal and to use a welding steel which, after being deposited, would have a carbon content of about 0.10%.

Chicago Oil Burner Association

A talk on "Activities of the Chicago Association of Commerce," by Harry Porter, district manager of the Century Electric Company, featured the June meeting of the Chicago Oil Burner Association, held June 14, in Chicago. Mr. Porter outlined the vast activities of this organization. At the conclusion of his address the association voted to join the Chicago Association of Commerce.

C. H. Cress, chairman of the publicity committee, reported that the oil burner association's billboards have been repainted. He also outlined the new association book containing the constitution and by-laws, list of members and Chicago district ordinances, as well as the distribution plan for this book.

Chairman Owens, for the membership committee, presented fourteen applications for affiliate membership, four applications for associate membership and one application for active membership, all of which were favorably acted upon.

Glen C. Sutton reported the continued improvement of Past President T. C. Kyle.

President Lyle Straight referred to the recent recommendation of the National Fire Protection Association on the matter of tank sizes, covered and uncovered, for domestic installation. A motion by Mr. Goudie that the association protest against some of the recommendations was passed. Another motion instructed the secretary to write the American Oil Burner Association extending an invitation to hold its 1928 convention in Chicago.

The association went on record as protesting against the several inspections required by the Chicago officials on oil-burner installations. President Straight appointed Vice-President Barnes as chairman of the ordinance committee, serving in the absence of Mr. Kyle, to draw up a suitable resolution on this subject.

New York Oil-Burner Dealers' Association Formed

At meetings held June 9 and 16, at the Hotel St. George, Brooklyn, N. Y., plans were formulated and an organization established that probably will bring together representatives of the many oil-burner manufacturers represented in the metropolitan area. Thirty-seven dealers met on the first evening and discussed the many problems involved. F. F. Lewis was elected president and an organization committee appointed to prepare an outline for organization.

The committee report was made at the second meeting, at which the following were elected as a board of governors: F. F. Lewis, N. J. Sage, L. D. Angell, J. S. Kaplin, R. W. Bowes, C. F. Leland, A. Zeamans, George J. Woehrlin and E. A. Pierce. J. S. Kaplin was elected secretary and A. Vaerenklau treasurer.

An interesting provision is that a dealer organization, by becoming a member, may have all of its salesmen and executives qualify as members, but only one delegate from each member organization is recognized as the mouthpiece of that member, and he only is allowed a vote. This arrangement appears to be an excellent method of preventing domination by the larger sales organizations, and seems to be fair to large and small groups. Twenty-eight companies have signed as members and eight more are reported to be almost sold.

Steel Boiler Manufacturers Organizing

An organization of manufacturers of steel heating boilers is under way, with the slogan of "Steel for Heating Boilers." Those active in the movement are R. B. Dickson, of the Kewanee Boiler Company, and John R. Collette, of the Pacific Steel Boiler Corporation.

An organization meeting was held in Cleveland late in June when steps were taken to outline a co-operative campaign furthering the use of steel heating boilers.

American Society of Heating and Ventilating Engineers

Heating Engineers Establish Basis for Rating Boilers

Society Takes Definite Action at Its Summer Meeting on New Committee Report. Proposed Code for Garage Heating Develops Diversity of Views

AFTER years of effort in attempts to solve the house-heating boiler rating problem, the American Society of Heating and Ventilating Engineers, at its semi-annual meeting in White Sulphur Springs, W. Va., June 28-30, took what many believe to be decisive action on the subject by "endorsing" a plan put forward by its Committee on the Rating of Low-Pressure Boilers. This committee, which was appointed in June, 1926, at the suggestion of the United States Bureau of Mines, "to review the work of previous committees and, if possible, suggest a solution satisfactory to all concerned," was later raised to the dignity of a committee of the council of the society. With Alfred Kellogg, consulting engineer, of Boston, as chairman, the personnel included the names of Director F. C. Houghten, of the A.S.H. & V.E. Research Laboratory; Percy Nicholls, supervising engineer, Fuel Section, U. S. Bureau of Mines Experiment Station, Pittsburgh; and L. E. Seeley, M.E., instructor of mechanical engineering at Yale University.

Included in the report is a "code for the rating of low-pressure solid-fuel steam heating boilers." It was a dramatic moment when the time came for a vote on the report and the passage of the resolution endorsing the committee's work was easily the high spot of the meeting.

In other respects, also, the meeting will go down as one of the most constructive in the society's history, the subjects of garage heating and ventilation, building insulation and a method for testing air filters receiving particular attention. The attendance was large, the character of the gathering being distinguished by the presence of many men prominent in fields indirectly connected with heating and ventilation.

Morning Session, June 28

"Progress in the science and art of heating and ventilation has never been so rapid as it is in this present day", said President F. Paul Anderson, in opening the thirty-third semi-annual meeting of the American Society of Heating and Ventilating Engineeers, in the ballroom of the Greenbrier, Tuesday morning. "In fact," said Dean Anderson, "the marvelous feats of Lindbergh and Byrd, commanding the admiration and adulation of the nation, are being paralleled in our field of endeavor and the year is bringing forth fruits of great value and significance to humanity."

Following brief talks by C. V. Haynes, of the entertainment committee, and his lieutenants, Roswell Farnham and R. C. Bolsinger, Owen Walther read the report prepared by the Committee on Garages of the National Fire Protection Association, of which he is chairman.

REPORT ON HEATING AND VENTILATION OF GARAGES

In this report which was designated as that of the committee of the N. F. P. A. on heating and ventilation of garages, Chairman Owen Walther presented a correlation which the committee had compiled of the requirements in various cities, covering such items as the location of the heating apparatus and the ventilation of garage storage space, and repair pits. In none of the cases were steam or water heating systems prohibited. It is usually specified, however, that boilers shall be in a separate room of fireproof construction. In several cases warm-air furnaces are not looked on with favor.

Considerable data on the subject of automobile exhaust gases were included, taken from Bureau of Mines' reports and other sources.

Among the conclusions expressed in the report are the following:

Automobile garages should be heated with either a direct or an indirect type of heating system, or with a combination of the two. Heating equipment should not be used which will permit air from within the garage to come in contact with temperatures which will ignite gasoline vapor.

All boilers or other heat-generating apparatus, where possible, should be located in a detached building. When located in an adjoining building, or inside of the garage proper, the equipment should be installed in a room of approved fire-resistive construction and having an entrance or entrances direct from outside the building.

In the case of an indirect type of heating system, the recirculation of air should be prohibited. Sufficient heating equipment should be installed to permit continuous operation of the ventilating system.

Ventilation of garages should be sufficient to prevent the accumulation of more than 1 part CO in 10,000 parts of air. The contamination of air in garages more nearly corresponds to the conditions in a vehicular tunnel where automobile engines are idling, rather than where the cars are in motion.

Downward circulation of air more effectively ventilates garages than does upward circulation.

The report included a proposed code on the heating and ventilation of commercial garages, which has been submitted to the National Fire Protection Association. The proposals in general follow those previously drafted by the committee and published in THE HEATING AND VENTILATING MAGAZINE for May, 1927. The revised section pertaining to the use of unit heaters or warm-air furnaces now reads: "The indirect type of system is any system in which the heat is transmitted through the surfaces of radiators or pipes over which air is forced and thereby heated; the heated air then being introduced, either directly

or by means of ducts, into the zone or area to be heated. Under this type of system shall be included any type of warm or hot-air system in which the air is not passed over a surface heated to the point of glowing or incandescence."

The committee recommended that natural ventilation be restricted to localities where the outside temperature did not fall below the freezing point, and that mechanical ventilation be required where this condition does not obtain. Recirculation was condemned and a definite supply of outside air required. The spirited discussion that followed was led by E. K. Campbell, who disagreed with the report in major points; especially the prohibition of recirculation and the restriction against warm air heating. He believed that recirculation should be required in known volume.

S. R. Lewis read a communication from E. B. Langenberg in which he recommended that tests be conducted on air in garages to determine both life and fire risks involved.

Contributions to the subject were made by W. H. Carrier, W. C. Randall, J. H. Kitchen, Harry M. Hart and Thornton Lewis. Mr. Walther said that his committee would be glad to have the additional information brought out by the discussion, and, upon the motion of Thornton Lewis, President Anderson named a committee, consisting of E. K. Campbell, Thornton Lewis and W. H. Carrier to confer with Mr. Walther in an endeavor to have the report of his committee concur, so far as might be possible, with the collective ideas of the society.

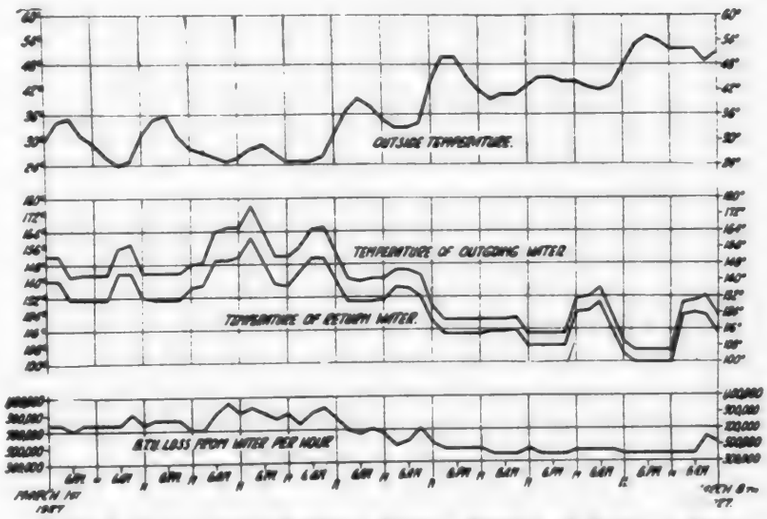
F. M. Holbrook then outlined the tests he had conducted, at the suggestion of H. P. Gant, to determine the actual heat requirements of a modern insulated office building, and to check the computations made for the heating installation.

Test Data on Insulated Office Building

This paper was presented solely as a record of tests on a cork-insulated office building and a comparison of the heat actually required with the calculated quantity; also to determine the saving through insulation.

The building under consideration is an office building at Lancaster, Pa., three-story, steel-frame, brick-faced construction, exposed on four sides and having a ground area of about 13,500 sq. ft. The side walls are of compound construction, including face brick, cinder-concrete block, and corkboard insulation. The roof is of reinforced concrete, corkboard and roofing paper. The windows are double-hung, single-glass sash, metal weather-stripped.

The heating plant is a forced hot water circulating system, arranged in two general circuits. Heat is supplied by steam from an adjacent manufacturing plant. The actual heat required by the building was determined by metering the condensate rejected from the shell and tube type heater used to heat the circulating water. The total installed radiation is 7,671 sq. ft.



Typical Temperature Readings During Portion of Tests on Heat Requirements of an Insulated Office Building

Heat transmission coefficients for the several types of building construction were calculated by standard formula, basic data being taken from the Guide or from other accepted tables.

Heat losses then were calculated for four types of building construction, the results being as follows:

SUMMARY OF TEST DATA ON INSULATED OFFICE BUILDING

Saving in heat loss due to 2-in. corkboard insulation:

Compound wall construction as built	240,800 B.T.U.	= 21.6%
13 in. plain brick wall construction	388,900 B.T.U.	= 28.9%
Roof only, as built	145,700 B.T.U.	= 62.2%

The radiation required for the four building constructions follow:

	Case 1 Compound Wall with Corkboard		Case 2 Compound Wall without Corkboard	
	B.T.U. per Hour	Sq. Ft. Radiation	B.T.U. per Hour	Sq. Ft. Radiation
Total loss through building	878,100	4,947	1,118,900	6,303
75% air change per hour	571,000	3,216	571,000	3,216
	1,449,100	8,163	1,689,900	9,519
Body heat credit	100,000	563	100,000	563
	1,349,100	7,600	1,589,900	8,956

	Case 3 Plain Brick Wall with Corkboard		Case 4 Plain Brick Wall without Corkboard	
	B.T.U. per Hour	Sq. Ft. Radiation	B.T.U. per Hour	Sq. Ft. Radiation
Total loss through building	960,500	5,411	1,349,400	7,608
75% air change per hour	571,000	3,216	571,000	3,216
	1,531,500	8,627	1,920,400	10,824
Body heat credit	100,000	563	100,000	563
	1,431,500	8,064	1,820,400	10,261

Allowance was made for the body heat of 250 occupants at 400 B.T.U. per hour. The determination of radiation for individual rooms was made on the basis of allowing 10% more radiation in rooms on the north and west walls than in rooms on the south and east exposures.

A test of the steam used to heat this building was run from January 21 to March 14, 1927, with the following results: This test consisted of measuring the steam condensate ejected from the water heater.

Duration of test—52 days.

Average temperature outside—38.2° F.

Minimum temperature outside—3° F.

Maximum temperature outside—69° F.

Average temperature inside—70° F.

Total steam—707,560 lb.

Average steam per hour—567 lb.

Average pressure of steam to heater—7 lb. gage.

Average temperature of condensate from heater—140° F.

Heat given up per lb. steam—1050 B.T.U.

Average heat given up by steam per hour—595,000 B.T.U.

A test of the heat delivered to the building by the hot water circulated through the radiators was made from March 1 to March 8, 1927, with the following results: This test consisted of measuring the flow of water by a flow-

meter and observing the temperature of the return water going to the heater and the outgoing water leaving the heater.

Duration of test—9 days.
Average temperature outside—38° F.
Minimum temperature outside—24° F.
Maximum temperature outside—55° F.
Average temperature inside—70° F.
Average temperature of water to heater (return water)—121.6° F.
Aver. temperature of water from heater (outgoing water)—131.0° F.
Average difference in temperature of water—9.4° F.
Average flow of water per hour—65,400 lb.
Average heat given up by the water per hour—615,000 B.T.U.

The calculated quantity of heat required to heat the building, corrected for the average temperature condition obtaining during the 52-day test was, allowing for the body heat of occupants for 8 hours per day, 655,000 B.T.U. Taking this figure as a base, a summary shows the following:

Heat required by calculation = 655,000 B.T.U. per hr. (1.00).
Heat given up by heating plant—test— = 615,000 B.T.U. per hr. (0.94).
Heat supplied to heating plant—test— = 595,000 B.T.U. per hr. (0.91).

The tests were made with commercial apparatus and carry only commercial accuracy, the possible error being perhaps as much as 5%. The test figures show that the amount of heat received by the heating plant from the steam was slightly less than the amount given up by the heating plant in heating the building. This discrepancy is within the accuracy expected of the test. The actual heat used, by test, appears to be considerably less than the expected heat required, by calculation. This saving probably would not always hold true because during the period of the test the average temperature, wind and storm conditions were not as severe as normally expected in this climate.

The conclusions that safely may be drawn are:

(1) The heat loss coefficients used, and the resultant calculations, are dependable and substantiated by test.

(2) The calculated savings in heat loss through the building constructions, due to the 2 in. of insulation are dependable. The savings for this building are 21.6% (240,800 B.T.U. per hour) for the construction used; 62.2% (145,700 B.T.U. per hour) for the roof only as built; and 28.9% (388,900 B.T.U. per hour) for a plain 13 in. brick wall construction. These percentages would be greater for constructions with larger heat losses.

"The results obtained from these tests were chiefly interesting," said Mr. Holbrook, "because of the close concurrence of preliminary calculation and actual operation and because of the size of the building." The fact that the heat used in the building was supplied from an outside source and could be accurately measured made the results accurate to a high degree.

Dean Anderson paid a tribute to Mr. Holbrook's contribution and Professor Willard added his impression that it was a conspicuous contribution substantiating the work of the society as presented in the Guide.

S. R. Lewis then told of his activities as chairman of the Committee on Research, and reported that the Research Laboratory would expend over $35,000 this year, of which $10,000 would be contributed by sources outside of the society. "The laboratory is fortunate above any commercial or industrial organization," he said, "in that it can command the best engineering brains in the country without cost." Mr. Lewis spoke of the importance of developing codes under which tests can be made and pointed out the great value of such codes where, with eight great universities co-operating in research work, all tests can be carried out on the same basis. These schools have agreed to develop research work in harmony with the Research Laboratory, spending a dollar for every dollar advanced by the laboratory.

Dean Anderson then voiced a plea that the heat meter developed in the laboratory be always designated as the Nicholls heat-flow meter, in view of the fact that Percy Nicholls was largely responsible for its design.

In the absence of L. A. Harding, the report of the Technical Advisory Committee on Heat Transmission was presented by F. C. Houghten, Director of the Research Laboratory.

IMPORTANT RESEARCH PROBLEMS BEING SOLVED

Mr. Houghten briefly sketched the field work that has been carried out with the Nicholls heat-flow meter in Pittsburgh and other cities and showed, with slides, some interesting curves made in these studies. The heat flow from buildings was shown to be constantly varying and not a constant over any appreciable period, changing with the wind and weather conditions. The work, he said, is very tedious and frequently a week is required in which to secure enough readings to work up into a set of curves. He said that Mr. Harding expected, in a few months, to have sufficient data to justify a bulletin on the subject.

R. M. Conner, director of the Research Laboratory of the American Gas Association, outlined the activities of his organization, which he characterized as determining minimum standards for construction and operation of gas equipment. He said that, with the great increase in the use of gas for domestic heating—some gas companies metering 50% of their send-out for this purpose—the testing of gas-fired boilers would soon occupy the laboratory.

Resolution Endorsing the Low-Pressure Heating Boiler Code

RESOLVED, that this code contained in the report of the Committee for Rating Low-Pressure Heating Boilers, Alfred Kellogg, chairman) be endorsed in principle as a preliminary code, with the understanding that the details, with the record of the discussion here, will be studied and revised by the committee for final presentation at the next annual meeting.

Resolved, that the code, in its present form, shall be submitted, with this understanding, to all interested organizations with request for favorable endorsement.

Presenting the report of the Committee for Rating Low-Pressure Heating Boilers, in the absence of Chairman Alfred K. Kellogg, S. R. Lewis said that the underlying idea had been that of simplicity. He very briefly outlined the recommendations of the committee, and, following a dramatic silence, moved the adoption of the report.

A spirited discussion was immediately precipitated, E. S. Hallett leading with a statement that the report was a sane and safe starting point that should accomplish a reasonable portion of the desired results. Argument was advanced that the old basis of rating power boilers on grate area had not been superseded by ratings based on test and that all attempts to rate on output had failed.

E. K. Campbell, H. M. Hart and Homer Linn joined in expressing their individual view points and C. E. Bronson, speaking for the manufacturers of steel boilers, entered an objection to the immediate adoption of the report on the ground that there had not been sufficient time in which to study it.

He questioned many items in the code and said that there was not a clear line of demarcation between capacity and method of selection. F. W. Herendeen, representing the National Boiler and Radiator Manufacturers' Association, told of his fourteen years' study of this problem and stated that, as there were involved four groups—the public, contractors, engineers and manufacturers—the project was of great importance and yet had not even been brought to the attention of the manufacturers of the equipment under consideration. He urged against the adoption of the code at this time.

John D. Cassell and James F. McIntire were in favor of accepting the code as a starting point, with the thought that desired changes and modifications could be made from time to time. Henry E. Longwell and Harry M. Hart sustained the committee in principle, Mr. Hart saying, "the code is a fine thing as far as it goes. It covers only one condition, but if we can get thus far it is farther than we have ever got before."

Following a question by W. H. Driscoll as to whether the committee would be willing to consider these suggestions, Dean Anderson asked Percy Nicholls to speak for the committee.

A SCIENTIST LEADS THE WAY

Ascending the platform, Mr. Nicholls vividly told the story of a man who wanted to buy a 5-H. P. motor. The selection, he said, would be made on the assumption that the "5 horse power" with which the motor was designated in many catalogs, meant just the same thing. Through years of honest rating, the electrical manufacturers, both large and small, have earned the confidence of the consumer, and the rating of 5 H. P. was confidently taken without the application of factors or other indications of inequality.

"Now," he said, "would the contractor, wanting a boiler to-day, make his selection on the basis of an equal rating of the various manufacturers? Does each boiler manufacturer, in publishing a rating of his product, mean the same thing?"

He went on to tell of the simplicity of the code under which electric motors are rated, the temperature rise in the machine being the controlling factor. The code for rating heating boilers had been developed along very similar lines, he said, and he suggested that, by changing a few words, it might even apply to the rating of motors. He pointed out that no constructive criticism had been offered by the boiler manufacturers.

It was obvious that this story, simply told, was the turning point in the consideration of the code and when a brief discussion produced a resolution of endorsement it was unanimously carried and the committee was retained to carry out its intent.

The resolution read:

"Resolved that this code be endorsed in principle as a preliminary code, with the understanding that the details, with the records of the discussion here, will be studied and revised by the committee for final presentation at the next annual meeting.

"Resolved that the code in its present form shall be submitted, with this understanding, to all interested organizations with request for favorable endorsement."

Morning Session, June 29

A discussion of the Code for Testing Building Insulation, held over from the previous session, opened the Wednesday morning meeting. After the injection of several interesting and valuable suggestions from L. I. Neale, of the U. S. Gypsum Company, Prof. F. B. Rowley, S. R. Lewis and others, the code was tentatively accepted, subject to slight modification by the committee which was continued and instructed to report at the next annual meeting in New York.

President Anderson then recounted the steps through which the Research Laboratory was brought into being, speaking in feeling terms of the breadth and sympathy of Dr. J. H. Holmes, at that time director of the U. S. Bureau of Mines, and Dr. Hood, of the Experiment Station in Pittsburgh. He then announced that Van H. Manning, formerly director of the Bureau of Mines and now at the head of the research work of the American Petroleum Institute, was present and would outline the work that was being done in research in this closely-allied field.

Mr. Manning told a very interesting story of the work being done by his organization, all in the laboratories of the engineering schools of the country and at an aggregate cost of over $100,000 a year. "Such is the overlapping nature of our field," he said, "that it reaches into almost every conceivable activity and phase of our national life." Mr. Manning said that the American Petroleum Institute would be glad to cooperate with the society in any desired way.

W. H. Driscoll then made a brief report "of progress" for the Survey Committee which, he said, had not yet brought its work to presentable form. He said that, while there were some real problems to be solved in connection with the development of the society, all moneys were being wisely expended and all of the activities should be pushed with vigor. He asked that new blood be brought into the society so that its future development might be assured and said that, at the annual meeting, he hoped to present a full report and analysis of conditions.

RADIATOR DEVELOPMENT INDICATES REAL PROGRESS

R. N. Trane presented his paper, "Designing a Gravity Extended Surface Heating Unit" in skeletonized form, with slides showing the important points.

Interesting Tests Determine Design of Copper Heating Unit

In this paper Mr. Trane described an exhaustive series of tests, mostly based on thermo-couple surveys, to arrive at the most effective commercial heating unit using extended surfaces. Copper was selected because of high conductivity, low cost and permanence.

Tests were made from which the emissivity of sheet copper was found, with the change resulting from painting. It was decided that 1.7 B.T.U. per square foot could be used for this coefficient.

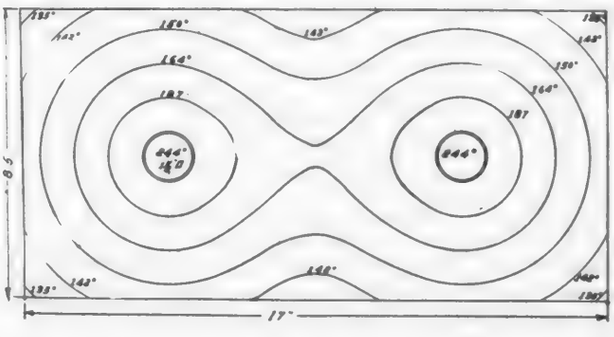
A long and carefully-devised series of tests was then begun, each desideratum being the subject of an investigation. First, the effect of varying the thickness of the extended surface was explored, the results being plotted on the basis of heat emitted per pound of material. This graph clearly showed the varying economy of different thicknesses.

The next series of tests was to determine the diameter of tube for maximum efficiency, and a plotting of data from five tubes varying from 1 in. to 2½ in. showed conclusively that over 200 B.T.U. per lb. of metal could be given off.

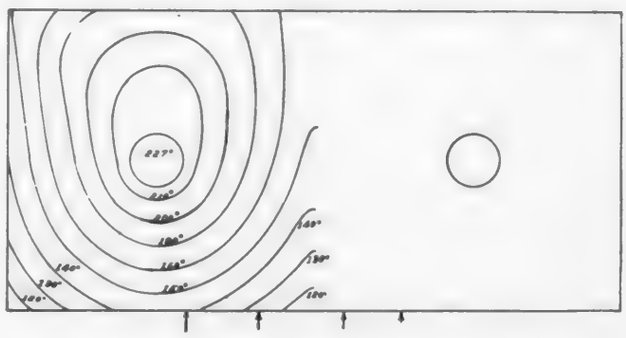
Sheets of various sizes and length-width ratios were next explored to see what would be the effect of passing air across and along the sheets and of changing the area. Isothermal lines were plotted with the sheet in still air. Then a stack of plates was made up and, with a specially-designed exploring thermocouple, isothermal lines were found when air was passing through the stack along each axis. The effect of stacking the plates and of causing a flow of air through them became evident. This test determined the horizontal setting of the plates as best, as, with the vertical setting the top portions became of little value. The former was practically 33% more efficient.

The next study was that of spacing the plates. If too close together the frictional resistance was objectionable; if too far apart the air was not fully heated. Still plotting on the basis of B.T.U. emitted for each pound of metal, the correct spacing was shown by the curves experimentally determined.

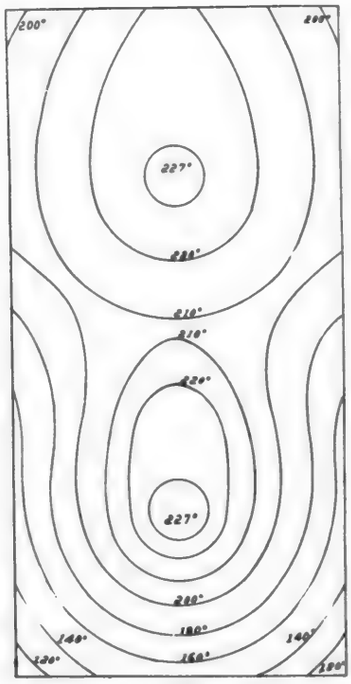
These purely experimental data served to define the desired variables and to give the economical maxima and



Iso-Thermal Lines Showing Heat Flow Through Extended-Surface Plate in Still Air



Distortion of Heat Flow in Extended-Surface Plate when Vertical with Vertical Air Movement



Distortion of Heat Flow in Extended-Surface Plate in Vertical Position with Lower Tube Shielding Upper Tube

minima. From them it was decided to standardize on stacks 6 in. high with 1 in. tubes. Then began a similarly exhausting series of tests to determine the effect of stacks and enclosures. The stack finally selected as standard is a vertical flue with the back surface curved to the front in a quarter-circumference having a radius equal to the thickness of the flue. It was found that a damper could be used with a loss of only about 3%. The effect of a grille having a free area of 80% was not objectionable, but below 75% opening the flow of air was restricted in proportion to the free opening.

Other tests were made to ascertain the change in heat delivery with changing stack heights, both for visible and concealed radiation.

Mr. Trane said that the weight per unit for 250 B.T.U. emission was reduced from approximately 1 lb. at the beginning of the investigation, to little more than ¼ lb. in the finished unit finally adopted.

Harry M. Nobis, Prof. A. C. Willard and W. H. Driscoll led the discussion, Mr. Driscoll stating that this paper indicates real progress in radiator design that would be applicable to a tremendous field—the American home.

At this point E. K. Campbell, for the Nominating Committee asked the society for assistance in solving a tough problem. He announced that the committee had proposed, for president, Professor A. C. Willard; for first vice-president, Thornton Lewis, and for treasurer, W. E. Gillham, and that acceptances had been secured from each, which brought hearty applause.

Mr. Campbell then said that the committee was unanimous in its desire to nominate L. A. Harding to be second vice-president, but that he had declined to serve. He said that a telegram signed by all of the past-presidents in attendance had been sent to Mr. Harding, but no reply had been received, and he asked that the entire meeting telegraph to Mr. Harding urging that he accept. It was suggested that Professor Willard also telephone to his former associate, and Dean Anderson suggested that a "Willardgram" would do the trick. A motion was carried to this effect.

The next paper was presented by A. P. Kratz, research professor, and M. K. Fahnestock, special research assistant, of the University of Illinois, and bore the title:

Effect of Enclosures on Radiator Performance

THE data presented in this paper were obtained incidental to an investigation being conducted by the Engineering Experiment Station of the University of Illinois, of which M. S. Ketchum, dean of the College of Engineering, is director, in co-operation with the Illinois Master Plumbers' Association and the National Boiler and Radiator Manufacturers' Association, under the supervision of A. C. Willard, professor of heating and ventilation and head of the department of mechanical engineering. This paper constitutes a partial summary of results which are to be presented in complete form in Bulletin No. 169, entitled "Effect of Enclosures on Direct Steam Radiator Performance," of the Engineering Experiment Station.

"The object of this particular phase of the investigation was to determine the effect of various types of radiator enclosures and shields on the steam condensing capacity of a radiator, in comparison with the capacity of the unenclosed radiator.

TESTING APPARATUS AND PROCEDURE

"The radiator used for these tests was a 20-section, 38-in., 3-col. cast-iron water-type radiator having a nominal area of 100 sq. ft. The surface was brushed and painted (not dipped) with two coats of flat black paint. This radiator was set on the main laboratory floor and partly surrounded by the test booth shown in Figs. 1 and 2. The back of the booth was placed 2½ in. from the radiator, and, together with the sides, served to shield the latter from transverse air currents. The top served to direct the vertical air currents, approximately the same as the ceiling of a room. The whole inside of the booth

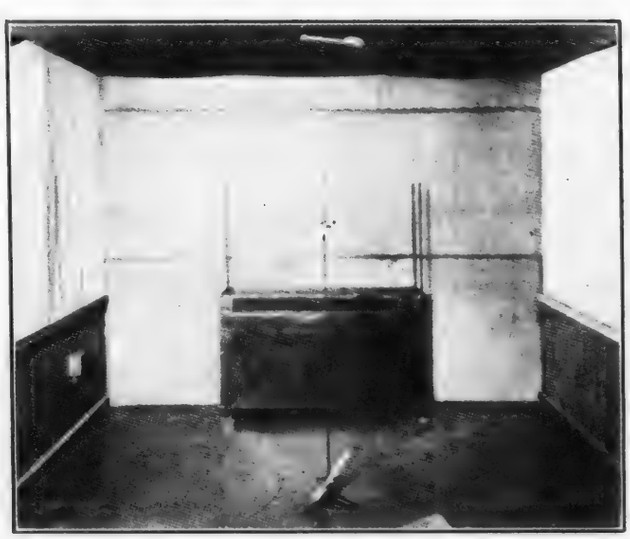


Fig. 1. Radiator Enclosure with Solid Front, Top and Ends

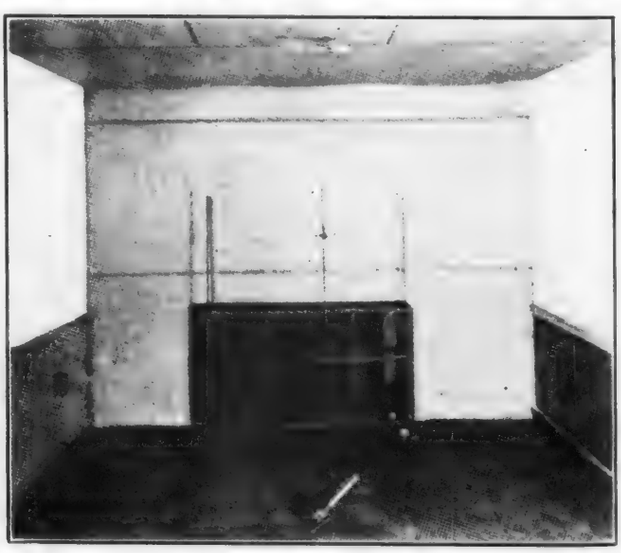


Fig. 2. Radiator Enclosure with Grilled Front and Ends, and Solid Top

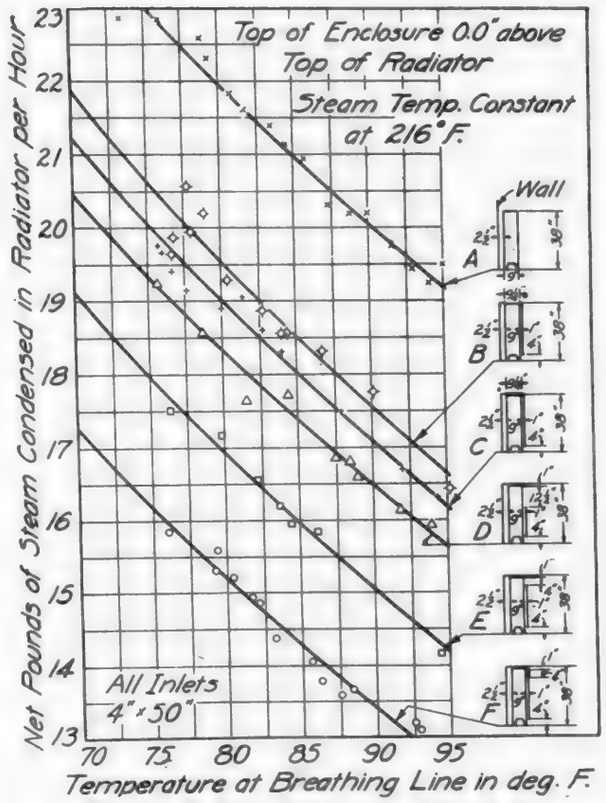


Fig. 3. Radiator Performance Curves for Various Outlets

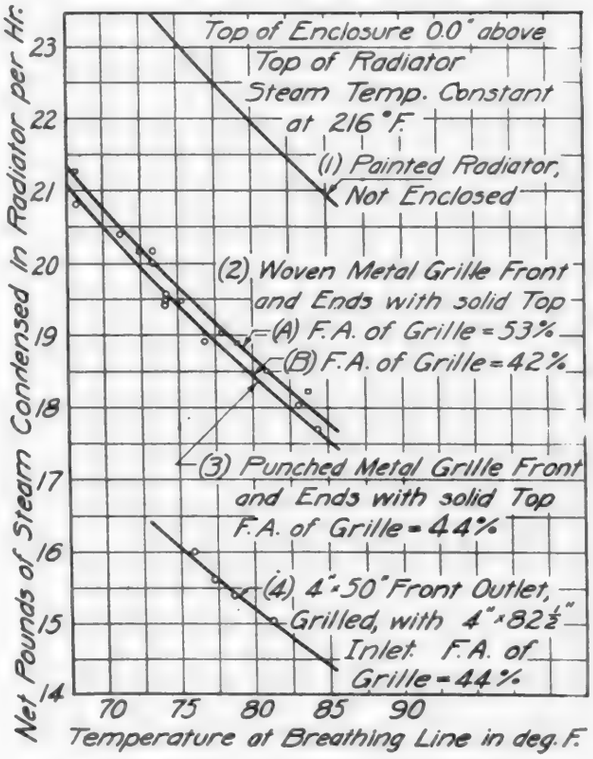

Top of Enclosure 0.0" above Top of Radiator
Steam Temp. Constant at 216° F.
(1) Painted Radiator, Not Enclosed
(2) Woven Metal Grille Front and Ends with Solid Top
(A) F.A. of Grille = 53%
(B) F.A. of Grille = 42%
(3) Punched Metal Grille Front and Ends with Solid Top
F.A. of Grille = 44%
(4) 4" × 50" Front Outlet, Grilled, with 4" × 82½" Inlet. F.A. of Grille = 44%
Net Pounds of Steam Condensed in Radiator per Hr.
Temperature at Breathing Line in deg. F.
23
22
21
20
19
18
17
16
15
14
70
75
80
85
90

Fig. 4. Radiator Performance Curves for Grilled Enclosures

presented surfaces similar to papered walls for receiving radiation. These conditions, while not exactly duplicating those of actual service where the radiator is set under a window which is in an exposed wall, did duplicate standard conditions under which practically all radiator tests have been conducted, and certainly afforded means of obtaining valid comparative results."

The paper then detailed the method of collecting and accounting for the condensate and of maintaining constant the conditions of the test.

"No commercial enclosures were used, but all enclosures were constructed so as to be adapted to limiting the effect to the particular factor being studied, and at the same time to avoid presenting features that were commercially impossible. All enclosures were painted inside and outside with two coats of flat black paint, and in all cases there was a clearance of 2½ in. between the back of the radiator and the back of the enclosure, and of 1 in. between the radiator and enclosure at the front. The end clearances were 8 in. and 4 in. The effects of height, and of sizes and types of openings were determined with enclosures having the sides and ends made of solid sheet iron. One of these is shown in Fig. 2, which also shows the arrangement made for extending the height. The various arrangements of the enclosures are shown corresponding to the curves in Figs. 3 and 4. An enclosure with grilled front and ends is shown in Fig. 2. Several constructions of grille work were used, having different free areas of openings."

PERFORMANCE OF THE UNENCLOSED RADIATOR

Discussing the performance of the radiator with no enclosure, the paper checks the experimental data against rating figures given in the Guide, and finds them within 6% of agreement, which was considered satisfactory inasmuch as the experimental radiator was painted black, increasing its radiation over that of a similar but bare radiator.

The groups of curves, presented with the paper, showing enclosure effect, are based upon a curve for the unenclosed radiator for the purpose of making a comparison, and all such comparisons are made with a room temperature of 80° F. at the breathing line.

EFFECT OF CHARACTER OF AIR OUTLET

The results of a series of tests run for the purpose of determining the effect of the location, size, and type of the air outlet in the enclosure are shown in Fig. 3. The comparative data are based upon the performance of the enclosures with the temperature of the steam in the radiator of 216° F. and the temperature at the breathing line at 80° F. These data are tabulated in Fig. 5 under enclosures Nos. 1 to 5. In all cases the top of the enclosure practically touched the top of the radiator, and the air inlet consisted of a 4-in. by 50-in. open slot at the bottom of the front of the enclosure. The best combination in this series was obtained with a 9¼ in. by 50 in. opening in the top of the enclosure. The area of the outlet was 462.5 sq. in. compared with 200 sq. in. for the inlet. The performance of this combination is shown in curve *B*, Fig. 3, and the relative capacity was 89.1%, using the steam condensing capacity of the unenclosed radiator at 80° F. room temperature at the breathing line as a base. A grille, having a ratio of free to gross area of 44%, or a total free area of 209.4 sq. in., was then placed in the outlet and the performance is shown in curve *C*. The relative capacity was reduced to 86.5%. Hence, adding the grille reduced the performance of the same enclosure 2.9%.

Curve *D* shows the performance when a 12½ in. by 50 in. outlet having an area of 625.0 sq. in. was used at the top of the front of the enclosure. The relative capacity of this combination was 83.5%. When the area of this outlet was reduced to 4 in. by 50 in., or 200 sq. in., as shown by curve *E*, the relative capacity was reduced to 77.0%. The addition of a grille, see curve *F*, reduced the relative capacity to 69.2%. In this case the effect of the grille on the same combination was to reduce the performance 10.1%.

RESULTS OF TESTS

From these results it is apparent that the use of an enclosure materially affects the performance of a radiator, and that the use of a front outlet, even with a comparatively large area, is less advantageous than the use of a top outlet. A grille causes more serious reduction when used with a front outlet than with a top outlet.

EFFECT OF HEIGHT OF ENCLOSURE

A series of tests also was run with three different heights of enclosures, namely, 38 in., 55½ in., and 72 in. In each case the enclosure had solid ends and front, a 4 in. by 50 in. open inlet at the bottom of the front, and a 4 in. by 50 in. grilled front outlet. The relative capacity for the 38 in. height was 69.2%. That for the 55½ in. height was 78.3%, and for the 72 in. height was 85.6%. These tests indicate that the height increases faster than the resulting increase in performance. The relative capacities based on a breathing line temperature of 80° F. also are shown in Fig. 5, enclosures Nos. 5, 6, and 7.

The performance of an enclosed radiator is appreciably increased by increasing the height of the enclosure, but even with the 72 in. height the performance was not as great as that for the unenclosed radiator.

INCREASING STEAM CONDENSING CAPACITY

A curve was obtained by using the best combination of inlet and outlet with an enclosure 72 in. in height, showing that by using the most advantageous combination of factors it is possible to increase the steam condensing capacity of an enclosed radiator above that of the same radiator unenclosed. The relative capacity in this case, expressed with the performance of the unenclosed radiator as a base was 109.1%, as indicated under enclosure No. 10, Fig. 5.

EFFECT OF GRILLED CONSTRUCTION

The curves in Fig. 4, and the tabulated values for enclosures Nos. 11, 12, 13 and 14, in Fig. 5, show the effect of enclosing the radiator with enclosures having full grilled construction for front and ends. Curve 4, was obtained with an enclosure having solid front, ends, and top, and a 4 in. by 50 in. grilled outlet at the top of the front. The inlet was 4 in. by 82½ in. With this arrangement a relative capacity of 69.2 was obtained. An enclosure having the same inlet, but having a solid top, and front and ends covered with a grille of punched metal having a ratio of free to gross area of 44% was then used. These results are shown by curve 3, and a relative capacity of 84.2% was obtained. The substitution of a woven metal grille with free area of 42% for the punched metal grille gave the same results as indicated by curve 2*B* which coincided with curve 3.

By using this same construction with a woven metal grille having a ratio of free to gross area of 53% the relative capacity was increased to 85.5%. These last three enclosures were very close approximations to the usual type of commercial enclosures, and while some improvement over the types having solid front and sides with slotted inlets and outlets was indicated, it is evident that any enclosure, unless extended to a considerable height above the top of the radiator, will reduce the condensation that would normally be expected from the bare radiator.

PROPOSED METHODS FOR FUTURE INVESTIGATIONS

It is realized that the results from such a laboratory study of the performance of radiators and enclosures only can be comparative. Certain problems, as for instance, the absolute performance of the radiators under service conditions, and a determination of the distribution of heat in the room, only can be studied by installing the radiators in rooms of standard size with actual exposed walls, and practical ratios of wall to glass and door surfaces. This involves controlled temperatures both inside and outside of the rooms, and the possibility of maintaining low temperatures outside of the rooms independent of weather conditions. Such provision is now being made by the Engineering Experiment Station at the University of Illinois.

Two such test rooms are now in the process of construction. These rooms will be approximately 9 ft. by 11 ft., with 9 ft. ceilings, and will be installed inside of a larger room completely insulated with 6 in. of corkboard. This larger room will contain refrigerating coils, making it possible to maintain controlled temperatures as low as 0° F. Each small room will have two exposures, one containing a window and one a door. Also, provision is being made whereby any desired temperature, down to 0° F., may be maintained above the ceilings or below the floors. By making use of these rooms it is expected that this study will be extended to radiators under service conditions in the near future.

This paper was highly commended by Dean Anderson and Mr. Hart, the latter asking that these data receive wide publicity.

The Technical Advisory Committee on Radiation, reporting through its chairman, F. D. Mensing, asked for suggestions as to the scope of its work, especially in view of the developments

Enclosure Number	Description of Enclosure: Height of Top of Enclosure Above Top of Radiator	Inlet	Outlet	Free Area of Inlet sq. in.	Free Area of Outlet sq. in.	Net Pounds of Steam Condensed in Radiator per Hour	Relative Condensing Capacity Percent	Enclosure Number
	Radiator not enclosed—Painted (not dipped) with two coats of black Pecora paint					21.93	100.0	
1	00"	4"×50" Across front	9½"×50" Open top	200.0	462.5	19.53	89.1	1
2	00"	4"×50" Across front	9½"×50" Grilled top	200.0	209.4	18.98	86.5	2
3	00"	4"×50" Across front	12½"×50" Open front	200.0	625.0	18.31	83.5	3
4	00"	4"×50" Across front	4"×50" Open front	200.0	200.0	16.89	77.0	4
5	00"	4"×50" Across front	4"×50" Grilled front	200.0	92.1	15.17	69.2	5
6	17½"	4"×50" Across front	4"×50" Grilled front	200.0	92.1	17.16	78.3	6
7	34"	4"×50" Across front	4"×50" Grilled front	200.0	92.1	18.77	85.6	7
8	00"	4"×82½" Across front and ends	9½"×50" Grilled top	330.0	209.4	19.43	88.6	8
9	00"	2"×82½" Across front and ends	9½"×50" Grilled top	165.0	209.4	18.09	82.5	9
10	34"	4"×82½" Across front and ends	9½"×50" Open top	330.0	462.5	23.92	109.1	10
11	00"	4"×82½" Across front and ends	4"×50" Grilled front	330.0	92.1	15.17	69.2	11
12	00"	Punched metal grille front and ends, solid top. Grillework beginning 4" above floor. F.A. of grille = 44%				18.47	84.2	12
13	00"	Woven metal grille front and ends, solid top. Grillework beginning 4" above floor. F.A. of grille = 53%				18.74	85.5	13
14	00"	Same as (13) with F.A. of Grille = 42%				18.47	84.2	14

Note: 20 Section, 38"-3 Column, (direct) C.I. Water Type Radiator used in tests.

Net Pounds of Steam Condensed in Radiator per Hour — 0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0

Note: Steam Temperature constant at 216°F. Breathing Line Temperature = 80°F.

Fig. 5. Tabulation of the Performance of 14 Radiator Enclosures

in non-ferrous radiators, and said that he hoped to make a complete report at the annual meeting.

A. C. ARMSTRONG INTRODUCES NEW BLOOD

An interesting story of the development of weatherproof metal windows, mainly through the impetus received from the work of the Research Laboratory, was told by A. C. Armstrong.

Some Studies of Infiltration of Air Through Windows

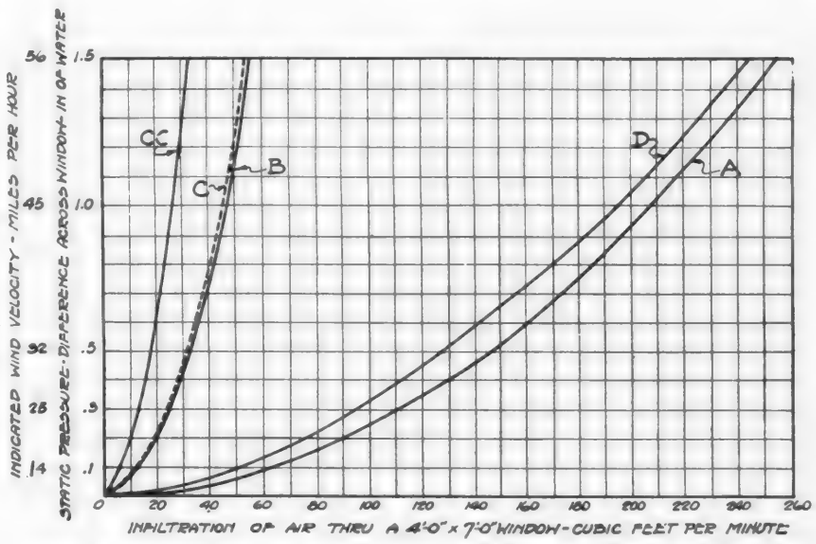
This paper was concerned principally with the problem of infiltration of air through windows in present-day high buildings and was based upon a series of experiments carried out—some by the author and some at the University of Wisconsin—to assist in the design of a line of metal windows to have low infiltration rates and to be sufficiently uniform to permit of guarantees of maximum leakage. The author frankly stated that the extensive series of tests that had been made in the A.S.H. & V.E. Research Laboratory in the past had been the incentive to produce this product and said that by such stimulation could the practical and commercial value of the laboratory be gaged.

Mr. Armstrong first outlined the problem of the heating engineer, architect and owner of the modern office building, hotel, apartment house and lofts, where the heat losses due to window infiltration may vary between 25% and 35% of the total loss. He analyzed the various combinations of infiltration conditions and heating plants and submitted a hypothetical problem where the substitution of 1000 windows having an infiltration of 12½ cu. ft. per minute for windows allowing 95 cu. ft. per minute, permitted a reduction of over 10,000 sq. ft. of radiation. Taking average figures he showed a net saving in first cost of nearly $14,000, allowing for the increased cost of weatherproof windows. The difference is again reflected by the saving in annual operating cost of over $2,500.

After calling attention to the fact that almost every item of machinery entering into building construction, such as boilers, pumps and elevators is required, by specification, to perform with satisfaction and a certain efficiency, Mr. Armstrong made a plea for the codification of window performance, as regards infiltration, suggesting that all specifications for windows incorporate the following:

The amount of infiltration of air through standard double-hung windows shall not be more than . . . cubic feet of air per foot of sash perimeter per minute when subjected to a static air pressure equivalent to the air pressure exerted by a wind of 25 miles per hour.

The window manufacturer shall submit for test before shipment a quantity of windows as selected by the architect from regular production in order to assure compliance with the above.



Curves Showing Infiltration of Air Through Various Types of Windows

CC—Infiltration Through Weatherproof Metal Windows, Model 25-W and 26-W (guaranteed); C—Infiltration Through Weatherproof Metal Windows, Model 24-S (guaranteed); B—Infiltration Through Weatherstripped Wood Windows, Averaged From Tests at Research Laboratory; D—Infiltration Through Typical Metal Double Hung Windows, Averaged From Tests by Meyer Voorhees and Armstrong; A—Infiltration Through Wood Windows Not Weatherstripped, Averaged From Tests of Schrader and Houghten.

These Curves Indicate, With 25 Mile Wind Velocities, the Following:

Class	Infiltration, cu. ft. per min.
CC	12.5
C	25
B	25
D	95
A	115

Tests to be conducted under the supervision of the architect at any laboratory in a manner similar to that described in the Transactions of the American Society of Heating and Ventilating Engineers, Vol. 30, 1924.

In leaving blank the allowable rate of infiltration, Mr. Armstrong pointed out that different types of buildings require different kinds of treatment in this respect. He recommended that, for severe exposures, and for hotels and apartment houses the infiltration be limited to ½ cu. ft. per minute per foot of sash perimeter, with a 25-mile wind, and, for buildings where comfort is not of such importance, a limit of 1 cu. ft. per minute with the same wind. "Following this procedure," he stated, "would put the responsibility squarely up to the manufacturer of windows, or to the weatherstrip manufacturer, where these are installed as an afterthought."

Mr. Armstrong then presented a series of test compilations for various kinds and types of windows, and showed the curves derived from these data. In giving the figures for metal windows manufactured by his company, he said that the experiments leading to the present design had progressed, stepwise, over a period of two years, and that the data obtained on them by Professor Larson, of the University of Wisconsin, were sufficiently uniform to permit guarantees along the lines suggested.

In submitting a graph giving characteristics of various types of windows, Mr. Armstrong presented the source data and concluded with this comment:

"At best the infiltration of air through windows is not a problem that can be solved with mathematical accuracy due to the various conditions that prevail in different buildings. Elevators, partitions, concentration of heat in various portions of the building, arrangement of courts and many other conditions have some influence on the problem. Therefore, an engineer is justifiably conservative if he makes use of these data in estimating the infiltration in any proposed building using double-hung windows.

"It is hoped that the above remarks point out the relationship between the problems of the window manufacturer and the engineer. The questions of heat losses, fuel consumption, radiation and heating plant belong rightly in the hands of the engineer and, so, wherever possible they have been eliminated from this discussion. But if on any building project the problem of infiltration of air through windows is not given proper consideration, if the cost of good windows and poor windows with their necessary economical or excessive heating plants are not balanced one against the other, the matter is not receiving sound engineering treatment."

In the discussion that followed, W. C. Randall, of the Detroit Steel Products Company, told of the experiments he had made, especially on casement win-

dows, which were more and more coming into use. He approved of the suggestion for a uniform specification based on performance as advocated by Mr. Armstrong, and said that the manufacturers of this class of window should get together and, at this early stage, set down such codes and fundamental principles that progress would be along logical and normal lines.

H. W. Whitten told of the simplified equipment he had developed for determining infiltration around windows and said that a large part of the business now being done by his organization was the calking and making tight of cracks around window casings.

"WILLARDGRAM" SAVES NOMINATING COMMITTEE

At this point President Anderson asked Professor Willard for his views on this proposal. Before complying, Professor Willard announced that he had succeeded in reaching Mr. Harding and that he had agreed to accept the nomination.

Professor Willard then gave a brief outline of the problems under consideration at Pittsburgh and at Illinois, Wisconsin and other universities in determining infiltration through walls and cracks of various kinds.

REPORT OF TECHNICAL ADVISORY COMMITTEE ON INFILTRATION

Speaking for the committee, Professor Willard stated that the research work of the society for the past half year could be summarized under three general headings. At Pittsburgh the work done, and in progress, has included tests of a plastered frame wall with wood siding and with stucco, and a plastered brick wall. Heat transmission tests have also been made of the latter wall. The brick wall is being checked for leakage after the plaster has been removed. If this check is satisfactory, the wall will be painted on the outside and again tested. Following the test on the brick wall, a tile wall will be substituted and tested with and without plaster.

At the University of Wisconsin the work done under the immediate supervision of Prof. G. L. Larson, in collaboration with Director F. C. Houghten, has included tests of a 13-in. brick wall, with double-hung wood sash window and frame. This preliminary work will give the necessary correlation of data secured at Madison as compared with data secured at Pittsburgh in the same type of apparatus. The complete program for the next year at Madison, as now outlined, is as follows:

SUGGESTED WALLS FOR TESTS AT THE UNIVERSITY OF WISCONSIN

(1) Brick wall with wood window and frame
  (a) Determine frame leakage
  (b) Determine reduction in leakage by locking window
  (c) Determine reduction by applying storm sash — different methods of application
  (d) Determine leakage for different cracks and clearances both locked and unlocked.

(2) 13-in. plain brick wall—joints not thoroughly slushed (as in practice) good grade of common brick.

(3) 13-in. plain brick wall—joints thoroughly slushed, good grade of common brick.

(4) 13-in. plain brick wall—joints not thoroughly slushed, extremely porous brick.

(5) 13-in. plain brick wall—joints not thoroughly slushed, glazed brick.

(6) Concrete walls—probably different mix and thickness.

After above walls are tested "plain," they may be either plastered or painted.

The work done and in progress at St. Louis under the general direction of S. R. Lewis, chairman of the Research Committee, and the immediate supervision of Director F. C. Houghten, is of a conspicuously original character involving many difficulties. For the first time, an investigation of the infiltration of air through plain and weather-stripped steel sash, as actually set in a modern skyscraper is being made by the research staff. The results of the work on the Southwestern Bell Telephone Building will be of the greatest interest to engineers, architects, contractors, and sash and weather-strip manufacturers.

At Professor Willard's suggestion, Mr. Houghten, with slides, showing pictures and graphs, outlined the interesting research that has been carried out in St. Louis, and is now completed. He said that it was a difficult proposition, sitting in a room a thousand miles from home, waiting for the wind to blow at just the desired velocity and from the right direction.

ARTIFICIAL WIND FOILS NATURE'S DELAYS

So it was determined to produce artificial conditions simulating the desired velocity, and this was accomplished by sucking air from the outlet box instead of forcing air into it. The results, he said, were exceptionally happy, and much valuable information was secured in a short space of time.

Mr. Houghten then told of the investigations that had been made in the Research Laboratory, determining the infiltration through partially-completed walls, one element being added at a time. The effect of painting of the mortar joints showed that these were more of a factor in infiltration than the brick itself.

S. R. LEWIS ORGANIZES TO CO-ORDINATE RESEARCH

S. R. Lewis laid before the meeting a report of an informal gathering held the previous evening at which was discussed the possibility of securing, through a joint committee, a complete co-ordination of all research on these lines that might be under way or contemplated.

Through the activities of Mr. Lewis, the meeting was attended by nearly a score of representatives of national organizations interested, either directly or indirectly, in heating and ventilation problems pertaining to health and comfort. He reported that this group had devoted nearly three hours to a comprehensive discussion, and had arrived at a point where he had been instructed to appoint a committee of three to make a survey and report to a meeting to be called in the early fall for consideration of its findings. This committee consists of R. M. Conner, American Gas Association, J. C. Fitts, Heating and Piping Contractors' National Association and F. C. Houghten, of the society.

Among those who came to White Sulphur Springs for this meeting were: R. M. Conner, American Gas Association; J. H. Bracken, Better Business Bureau; F. W. Herendeen, National Boiler and Radiator Manufacturers' Association; E. B. Cresap, National Association of Fan Manufacturers; F. C. Bradbury, Crane Company; Dr. H. E. Kleinschmidt, National Tuberculosis Association; Thomas J. Duffield, New York Commission on Ventilation; Leroy E. Kern, American Institute of Architects; L. I. Neale, U. S. Gypsum Company, and C. H. B. Hotchkiss, Purdue University.

Mr. Lewis asked for the approval of the meeting on his activities, and a motion to that effect was passed.

It was then announced that the University of Kentucky had joined the program of co-operative research with the society, to the extent of appropriating $2000 in funds and supplying its new thermal laboratory for this purpose.

Morning Session, June 30

In presenting a proposed code for testing air filters Prof. F. D. Rowley, chairman, drew attention to the fact that there are four main elements involved, namely, air rating, filter resistance, filter capacity and efficiency. One of the preliminary steps, he said, in testing air filters is first to select dust determinators suitable for field use. Professor Rowley's report was accepted and it was voted to appoint a new technical advisory committee on the subject, with Professor Rowley as chairman.

NEW PIPE SIZE DATA PRESENTED

On the subject of pipe sizes, Director Houghten outlined the work conducted at the Research Laboratory, leading up to the recent investigation, which has produced new data showing a material divergence from the data contained in the Guide. Director Houghten stated that serious discrepancies in some of the early test results were caused by defective nipples and that the divergence from normal flow was so great as to puzzle the laboratory staff. The rebuilding of the pipe set-up with new nipples and fittings produced data that checked with the rest of the investiga-

tion. Mr. Houghten said that manufacturers of pipe fittings have expressed great interest in this matter and that undoubtedly a special study would be made of the irregularity in pipe fittings.

If the data recently obtained are confirmed, Director Houghten said, they would change materially the application of the Babcock formula.

For the Technical Advisory Committee on Temperature, Humidity and Air Motion, W. H. Carrier, chairman, reported a continuation of the investigation covering heat losses from the human body and the determination of the loss of sensible and latent heat. The work done, he said, shows a definite relation to exist between these losses. Supplementing Mr. Carrier's report, Director Houghten described a series of experiments on the points discussed and showed curves definitely identifying the relationship of sensible and latent heat, based on units of surface and not on the weight of the subject.

The data, it was shown, furnish an exact heat balance of the human body, similar to a boiler heat balance.

In the discussion Messrs. Hill and Carrier said the data secured again emphasized the wonderful heat regulating mechanism of the human body.

The next paper was presented by A. J. Nesbitt, of Atlantic City, N. J., on the subject of:

Ten Fundamentals of Unit Ventilation and Their Application

This paper was based on one read some months ago at a meeting of the Philadelphia Chapter. After a brief survey of what is known of the beginning of this art, Mr. Nesbitt followed the development of unit heaters to the present day, bringing out the features that had been patented from time to time and concluded with a recital of what he considered to be the vital fundamentals involved. These were:

1. To obtain the best results, the unit should be placed along the outside wall and in the center of the wall.
2. Care should be used in locating the vent flue or vent outlet so that it is on a direct line opposite the ventilating unit.
3. Vent flue areas should be restricted where the law permits, to 20 sq. in. cross-section of flue area per 100 cu. ft. of air.
4. Where thermostatic control is used it is important that the thermostat be located as nearly as possible on a direct line opposite the ventilating unit.
5. Where conditions permit, use the blast system, and in no case provide sufficient radiation to heat the room independent of the ventilating unit.

In the discussion Thornton Lewis brought up the point that an outlet through the lower part of a door added to the fire risk. Mr. Nesbitt thought that there would be less danger on this account than with flues to the roof.

Prof. A. C. Willard offered a motion, which was adopted, providing for the appointment of a vice-chairman of the Research Committee. Thornton Lewis announced the forthcoming one hundred and fiftieth anniversary of the birth of Benjamin Franklin, whom he described as the first heating and ventilating engineer. He offered a motion that the society adopt Benjamin Franklin as its patron saint, and it was unanimously carried.

An announcement that a national fuel conference would be held in St. Louis, October 1, under the management of the American Society of Mechanical Engineers led to the endorsement of the conference by a formal vote of the society.

Mrs. Olive E. Frank then read her contribution to the literature of the art entitled:

Heat Transfer in Tubular Water Heaters

In this paper Mrs. Frank presented formulae for determining the required heating surfaces, resulting temperature differences and other desiderata both for storage and instantaneous heaters.

Referring to the characteristics and desirability of each of these types, she said:

"Closed heaters of the tubular type are divided into two classes—storage and instantaneous. The instantaneous may have the steam or the water in the tubes.

"Storage heaters are always steam tube type—that is the steam is in the tubes and the water to be heated is around the tubes. They provide a large space for storing hot water, so a supply is available for peak loads. Tubes of either copper or brass are contained in the bottom of the tank, through which steam is passed to heat the water. The water circulates in the tank by gravity, when none is being drawn by the system. The tubes in the storage type are usually 1¼ in. to 1½ in. in diameter, because there is nothing to be gained from using smaller diameter tubes, and also because smaller tubes of any appreciable length soon fill with water in the discharge end and the friction of the water makes necessary a higher initial steam pressure.

"Instantaneous heaters are either of the steam-tube type or water-tube type, but are more generally used as the water-tube type. In this type no storage capacity is provided and the water is heated as fast as it is drawn. The steam is in the shell around the tubes, and condensing gives up its heat.

"In choosing the type of heater to be used due consideration must be given the available steam supply. Instantaneous heaters require steam only when water is being drawn, therefore, if the demand for hot water is intermittent a steam supply up to the total demand must be available at all times in order to insure proper functioning of the heater. Exhaust steam from steam driven machines can be used if the demand for water does not exceed the steam supply available, but, generally speaking, when exhaust steam is to be utilized for heating water for which the demand is not steady, it is better to use the storage tank heater.

"Storage heaters generally are used for laundries, hotels, hospitals, office buildings, etc., where the demand is intermittent. Instantaneous heaters generally are used for feed-water service, hot water heating systems, swimming pools and for connection to storage tanks. However, the type of heater to use depends on the steam supply. If steam is purchased and any quantity is available, it is better to heat the water as fast as it is required in an instantaneous heater, but if steam is generated in the individual power plant, to use instantaneous heaters would mean an oversize boiler installation in order to have available at all times sufficient steam for peak load conditions.

"There are large hospital and hotel installations where the load is almost constant for 7 or 8 hours a day where it is less expensive to install instantaneous heaters than to operate the storage type. There are also large installations where the water lines carry a large storage supply and the water can be heated in instantaneous heaters and constantly recirculated much more economically than if large storage heaters, which, when built for high working water pressures are expensive, are chosen. The condition of water to be heated also has a good deal to do with the type of heater to install. If the water contains much foreign material that will fill up the tubes of an instantaneous water-tube type heater, it may be necessary to use the storage type, where the scale can more easily be removed from the heating surface, even though the steam supply is purchased."

Before adjourning it was announced that the next annual meeting of the society will be held in New York. Following the usual resolutions, including one for the entertainment committee, mentioning particularly J. R. Shanklin, of Charleston, W. Va., in whose home State the meeting was held, the convention adjourned.

Entertainment

A novel feature of the meeting was a golf tournament for the Research Laboratory cup which was put up by friends of the laboratory. According to the terms of the competition the cup is

to be won three times before becoming permanently the possession of the winner. The first name to be engraved on the cup, as the result of the tourney at White Sulphur Springs is Alec McClintock, who led the field with a net score of 70. In the Handicap events the winners were: Class A, M. F. Blankin; in Class B, P. H. Seward; in Class C, E. F. Henkel. In the ladies' tournament first prize went to Mrs. French, of Philadelphia, and second prize to Mrs. Blankin, of Philadelphia.

DINNER DANCE WEDNESDAY NIGHT

Much hilarity attended the dinner dance of the society which was held Wednesday night at the Greenbrier. The speakers were all from the audience, no officers being permitted to take the floor. Each speech was limited to two minutes, those transgressing being brought up short by the sounding of a gong, as in a prize fight.

At the bridge party for the ladies, the first prize went to Mrs. J. I. Lyle, and the second to Mrs. F. Paul Anderson.

The Reason for the Variable Lengths of Pipe

Finished pipe is made in variable lengths of about 20 ft., although the skelp is made in practically uniform lengths for each pipe size. This variation is due to either of two causes. First, in the welding of the pipe certain irregularities sometimes appear at the ends caused by the pipe entering and leaving the rolls or the bell. These ends are cut or "cropped" off immediately before threading, and, in doing so, the end is not cropped at any fixed or standard distance, because the irregularities may vary in length.

Second, in making certain sizes of pipe it is sometimes necessary to "draw down" pipe of a larger size to the diameter required, especially where an exceptionally strong weld is required. The "draw down" lengthens the pipe while reducing its diameter, giving the finished pipe a greater length than the original piece of skelp. This, of course, will explain why lengths of pipe vary and why the cutting of pipe to exact length, as specified by the purchaser, is always accompanied by an increased cost.

New Officers of Michigan Chapter

Officers of the Michigan Chapter, A. S. H. & V. E. elected at the chapter's annual meeting, May 23, at the Hawthorne Valley Golf Club, are as follows:

President, N. W. Calvert; vice-president, W. A. Rowe; secretary, William G. Boales; treasurer, H. A. Hamlin. Governors: J. H. Walker, J. L. Fuller and Bruce Wigle. The meeting itself was preceded by a golf tournament.

C. V. Haynes, vice-president of the Hoffman Specialty Company, was the principal speaker, his talk being devoted to society matters.

Growth and Specialization Cause Changes in A. S. M. E. Publications

DUE largely to increased numerical growth of the American Society of Mechanical Engineers, and to the tremendous diversification of its interests, it has been found necessary to make radical changes in the publications of the society. The principal change is to be in the editing of the Transactions. When the society was young these records contained almost all of the presented papers and discussions; as the membership increased and the meetings grew in program volume it became impossible to include all of the proceedings and the practice developed of attempting to hold the volume to reasonable limits by including only the papers of greatest import and interest.

With the rapidly expanding scope of the society during the last ten years it has become an increasingly difficult problem to carry on along these prescribed lines. As the result of a careful study of the situation by a special committee, it has been determined to enlarge the Transactions, so that they shall become a record of the society's activities and a thorough index of all its publications.

Transactions will contain a portrait of the president, a list of officers and committees, reports of committees and of the business meeting, the presidential address, a list of past-presidents and honorary members, an index (with notes) of all reports of technical committees and of all papers presented at authorized meetings, whether annual, spring, divisional, regional, or local, and a statement of the form and place in which these papers are published, if at all; a necrology, the constitution, by-laws, and rules, and a calendar of meetings, society, divisional, and local.

In addition to the above there will be a group of four classes of publications which will be correlated in form and make-up. This group will consist of:

1. Mechanical Engineering.
2. Preprints of papers prior to presentation at meetings.
3. Papers, with discussions, which constitute the final record.
4. Quarterlies for each of the professional divisions.

All of these will approximate the 8½ in. x 11 in. size so that they will file with the standard letter sheet.

"Mechanical Engineering." This will retain its present complexion and trend of development, except that it will select for full publication only the most outstanding papers. Synopses of papers appearing in the divisional quarterlies will be included. This publication will meet the general engineering needs of the membership, leaving the Quarterlies (see below) to satisfy the specialist.

Preprints. These will be preprints of the papers. They will be punched for filing, and will be distributed before the meetings on request. Suitable request forms will be printed in the *A.S.M.E. News.*

Papers, with Discussions. This will be the final form of the papers. They will have the same make-up as the Preprints and Mechanical Engineering, and will come punched.

Professional Division Quarterlies. All edited papers presented before each professional division will be bound together and mailed quarterly to the membership of that division. Advertising will not be carried.

Complete Papers Bound. In addition, it is planned to have about 750 complete sets of papers bound and distributed to designated depositories throughout the world. A limited number will be available for sale to libraries, individuals, etc.

Merger of Seven Boiler and Radiator Manufacturers

AN important merger has been announced of seven boiler and radiator manufacturers, located in New York, Pennsylvania and Massachusetts. The new organization will be known as the National Radiator Company, with headquarters in Utica, N. Y.

Included in the merger are the National Radiator Company and the Union Radiator Company, both of Johnstown, Pa.; Utica Heater Company, Utica, N. Y.; Niagara Radiator Company, North Tonawanda, N. Y.; Pierce, Butler & Pierce Mfg. Corporation, Oswego, N. Y.; Continental Heater Corporation, Dunkirk, N. Y.; and the Gurney Heater Mfg. Company, Boston, Mass.

Edward Norris, president of the Utica Heater Company, it is announced, will be president of the new organization.

Heating Plants as Fixtures

1. As Between Vendor and Vendee
2. As Between Mortgagor and Mortgagee

By John Simpson

IN this series of articles Mr. Simpson will discuss the question of whether a heating plant is a fixture (1) as between grantor and grantee or vendor and vendee of the realty, (2) as between mortgagor and mortgagee, (3) as between landlord and tenant, (4) as between the owner of the realty and the conditional seller of the heating plant, (5) as the subjects of mechanics' liens, and (6) as between owner and insurer.

THERE is much conflict among the decisions on the question of what is or is not a fixture. The rule in regard to heating plants is the same as that in regard to fixtures in general. The true criterion of a fixture is said to be the union of the following requisites: (1) Actual annexation to the realty, or something appurtenant thereto; (2) application to the use or purpose to which that part of the realty with which it is connected is appropriated; and (3) the intention of the party making the annexation to make a permanent accession to the freehold. American Radiator Co. v. Pendelton, 62 Wash. 56, 112 Pac. 1117.

In the application of that rule it is clear that each case must be governed by its own facts and circumstances. Different cases, of course, may approach each other so closely in similarity of facts and circumstances that they may be regarded as "parallel cases," or so nearly alike that they would be decided, in the same jurisdiction, at least, in the same way.

The relations between the parties making claim to the heating plant must also be taken into consideration. Chief among these must be considered the question of whether the plant is a fixture (1) as between grantor and grantee, or vendor and vendee, of the realty; (2) as between mortgagor and mortgagee; (3) as between landlord and tenant; (4) as between the owner of the realty and the conditional seller of the heating plant; (5) as the subject of mechanics' liens; (6) as between owner and insurer.

AS BETWEEN VENDOR AND VENDEE

As between vendor and vendee it is generally held that a heating plant and its component parts attached to the building are realty.

Article 467 of the Louisiana Civil Code, as amended by Act No. 51 of 1912, provides that "wire screens, water pipes, gas pipes, sewerage pipes, heating pipes, radiators, electric wires, electric and gas lighting fixtures, bathtubs, lavatories, closets, sinks, gas plants, meters and electric light plants, heating plants and furnaces, when actually connected with or attached to the building by the owner for the use or convenience of the building, are immovable in their nature." In an action by the purchaser of a four-story building against the seller for damages for the removal from the property of a water heater attached to a tank and pipes, and forming a part of the hot water system of the building, the Louisiana Supreme Court holds, Scott v. Brennan, 109 So. 822, that, under the terms of the statute as quoted, the heater was not a "movable" and could not be removed by the vendor after sale of the building, although water heaters are not expressly named in the statute.

A furnace and boiler in a theatre building, resting on a foundation in the basement and encased in brick and not removable without tearing away the masonry, together with the pipes and radiators, which could have been detached without material injury to the building, were held to be fixtures, which passed upon a sale of the realty. Filley v. Christopher, 39 Wash. 22, 80 Pac. 834.

Boiler, heaters, radiators and ranges, would, the New York Appellate Division says, ordinarily pass with the freehold, i. e., they are not personalty, but realty.

A purchaser at foreclosure sale of land and unfinished houses thereon sought to be relieved from his purchase because he had understood that certain boilers, heaters, radiators and ranges upon the premises were intended to be permanently connected with the houses and would pass with the title, but he claimed that they retained their character as chattels because they were delivered to the original owner of the property on conditional sale, and that the title to them had never passed out of the sellers.

His motion for relief from his purchase was denied because there was no proof of the sellers' claim that they had parted with the chattels on a conditional sale. It was necessary that it be shown that the sellers were entitled to sever and take them away. Some evidence other than bare assertion was required that the sellers' claims were made in good faith and rested on a basis of right. Murphy v. Smith, 61 N. Y. App. Div. 575.

But where a mill "heater" was detached, and another piece substituted for it, a different rule was applied to the detached "heater" which was held to be personalty, and not a part of the machinery connected with and appurtenant to the realty. Smith v. People, 99 Ill. 445.

A basement furnace, so connected with the house that, in order to remove it, it would be necessary to take down brick work adjoining it and probably cause the ceiling to fall, was held a fixture which passed with the realty to a purchaser. Main v. Schwarzwaelder, 4 E. D. Smith, (N. Y.) 273.

AS BETWEEN OWNER AND MORTGAGEE

As between mortgagor and mortgagee of the realty, the rule is practically the same as between vendor and vendee. A mortgage covers the fixtures attached to the property mortgaged. The general rule as to fixtures between mortgagor and mortgagee is that all annexations to realty pass by the mortgage to the mortgagee, unless by express terms the mortgagor excepts them from the terms of the conveyance. Annexations made after the execution of the mortgage are subject to the same rules as those made before. Additions of a permanent nature by way of improvements on mortgaged property, made by the owner or mortgagor, are regarded as a part of the mortgaged property. Williams v. Chicago Exhibition Co., 188 Ill. 19.

As between owner and mortgagee it will be presumed that the owner of the land intended the improvement to be an accessory to the freehold, and a lasting benefit thereto, and not a mere temporary improvement to be taken away by him if he sells the land, or a mortgage thereon is foreclosed. A mere secret intention of the owner to remove it at some future time will not alter the case. Tyler v. White, 68 Mo. App. 607; National Bank of Catasauqua v. North, 160 Pa. St. 303.

A steam heating plant consisting of a boiler in the basement of a dwelling house, with iron pipes therefrom throughout the house and attached to radiators, and the radiators themselves, became, it was held, a fixture and a part of the freehold when annexed and fitted into the building by the owner, and passed to a subsequent mortgagee of the realty. Tyler v. White, 68 Mo. App. 607.

"It would be a startling proposition," the court said, "to announce that after a vendor had conveyed his house and lot, he might enter, detach and remove an ordinary steam heating apparatus which had manifestly gone into and be-

came part and parcel of the dwelling. These plants are necessarily, in their very nature, of a permanent character. This is especially true in reference to such improvements when put in by the owner of the freehold. They might, in some instances, be considered temporary when placed in the building by a mere tenant, for it might well be argued that he intended the same for his temporary convenience to be used during his occupancy and removed when he should vacate the building. But where such improvements are attached by the owner of the property at the time, it would be against all reason and common experience to claim that they were not permanent and not intended as a fixed annexation to the property."

The position of a conditional purchaser of the premises is substantially that of a mortgagor. So, a furnace placed upon a masonry foundation with connecting pipes and registers put in by conditional purchaser was held realty and not removable by purchaser on vacating the house before completing payments. Gunderson v. Kennedy, 104 Ill. App. 117.

A water heating apparatus consisting of a heater, radiators and piping, set up in a dwelling house by the owner, were held annexations of such a character as to be apparently intended for the permanent use and enjoyment of the realty and, therefore, were covered by a mortgage. Young v. Hatch, 99 Me. 465.

As between mortgagor and mortgagee a warm-air furnace, put into a dwelling house as a permanent improvement to heat various rooms on different floors, its base set in cement with 1 in. or 2 in. of cement close up around the furnace, was held to be a fixture attached to the realty, although it could be taken to pieces and put up in some other house of equal size. Pratt v. Baker, 92 Hun (N. Y.) 331.

As between mortgagor and mortgagee, three steam boilers, two horizontal and one upright, with about 10,000 ft. of steam piping connected with the boilers and running through the mortgaged buildings and returning to the boilers, used for heating purposes in the factory, were held to be part of the realty. Some of the pipes were placed on pieces of wood along the floor, and the rest along the walls and partitions; the latter pipes being supported in place by iron rests or brackets, nailed upon pieces of wood, which were firmly nailed to the walls or partitions with wrought-iron nails or spikes.

The court said: "As between mortgagor and mortgagee, when we have once established the facts, that a thing appertains to the real estate, is necessary for its enjoyment, and is *permanently* attached to the freehold, its character as a fixture resulting to the benefit of the mortgagee is determined. As to the permanence, that does not depend so much upon the degree of physical force with which the thing is attached, as upon the motive and intention of the party attaching it. If the article is attached for temporary use, with the intention of removing it, a mortgagee cannot interfere with its removal by the mortgagor; if it is placed there for the *permanent* improvement of the freehold, he may." Quinby v. Manhattan Cloth & Paper Co., 24 N. J. Eq. 260.

As between a mortgagee of the realty and the holder of a chattel mortgage, the machinery and apparatus for furnishing power, light and heat to factory buildings, were held to be part of the realty. These included the steam engine, securely and permanently bolted to a foundation set 8 ft. or 10 ft. deep in the ground, put in for permanent use, with its appurtenances, and the boilers which were a necessary adjunct to it, also the shafting, belting, couplings and pulleys to communicate the power.

Some of the heating pipes were laid on hooks attached to boards fastened to the walls. These might be removed without disturbing the boards or hooks. In one place there were two nests of piping which rested on the floor, without being attached to it. Such pipes so attached for heating purposes were held to be fixtures. Those which rested on the floor were not to be excepted under the circumstances. They were part of the system of piping in the building. Keeler v. Keeler, 31 N. J. Eq. 181.

As between owner and mortgagee, cast-iron pipes connecting with the boilers for heating the mills, and attached to the main beams by iron slings fastened with bolts and screws were held to be so attached as to be part of the freehold. Ex parte Wilson (1835) 2 Mont. & Ayr. (Eng.) 61. The court said: "The general and early rule was, that whatever is attached to, is part of the freehold; exceptions were made, in favor of tenants, that whatever a tenant fixed during his term he might remove during his term, unless such removal would cause material damage to the freehold. But if the owner fixes anything to the freehold, it becomes permanently fixed, and cannot be removed; so that if a tenant fixes, and execution issues against him, the sheriff may remove such fixtures, but not if fixed by the owner."

Radiators, known as "Mason radiators," connected with a factory building by steam-pipes and attached to the floor by screws, were held to be part of the realty as between the mortgagees of the realty and the receivers of the owners, an insolvent corporation. There was no doubt that they were intended to be permanent accessions to the freehold; and the fact that the owners dealt with them as personal property in their accounts and in insuring them, and that the assessors, in taxing them, treated them as personal property, did not, it was held, control the question. Whether they were to be regarded as personal or real was to be determined by the following considerations: Whether they were actually annexed to the realty or something appurtenant thereto; whether they were applied to the use or purpose for which that part of the realty with which they were connected was appropriated, and whether the party making the annexation intended to make thereby a permanent accession to the freehold. Watson v. Watson Manufacturing Co., 30 N. J. Eq. 483.

The steam radiators in a hotel were held, as between mortgagor and mortgagee, or vendor and vendee, to be a part of the realty, by the Minnesota Supreme Court, Capehart v. Foster, 61 Minn. 132, 63 N. W. 257, where it was held at the same time that a different rule applied to the gas fixtures, which were held personalty, under the great weight of authority, although the court considered the doctrine as to gas fixtures doubtful in principle.

"The steam radiators were attached to the steam pipes at the floor on which they rested, by being screwed to those pipes. We are of the opinion that these radiators should be held to be a part of the realty. The distinction thus made between them and the gas fixtures is not clear in principle. But the rule applied to gas fixtures must be regarded as rather an arbitrary exception to the general rule, and should not be extended to such fixtures as radiators. These radiators were put in immediately after the building was erected. There is no reason for holding that the owner did not intend them to be permanently annexed to the steam plant, and, therefore, permanently attached to the realty. He might remove or change them, and so might he remove or change the boiler, which is also a part of the steam plant. Such radiators are an essential part of such plant, and are rarely furnished by tenants or temporary occupants of buildings as a part of the furniture brought with them or carried away with them, but the owner who furnishes the rest of such plant usually furnishes the radiators also. When, under ordinary circumstances, the owner of the building attaches such radiators to his steam plant, it should be held that he intended them to be permanently annexed to the realty. We are cited to National Bank v. North, 160 Pa. St. 303, 28 Atl. 694, which holds to the contrary. This case holds that such radiators are analogous to gas fixtures, and, therefore, not a part of the realty. By following the same process of reasoning by analogy you would strip a house of all modern improvements, and by continuing the process you would overturn the greater part of the law of fixtures. A correct rule should not, in his manner, be overturned by an inconsistent exception."

In the Pennsylvania case referred to in Capehart v. Foster, radiators installed by the owner in a dwelling house, with the valves attached thereto were held to be personalty and subject to levy as against the claims of the mortgagee. Any secret intention of the owner to annex the entire steam heating apparatus to the building was deemed to have been abandoned by him so far as the radiators and valves were concerned by his silence at the levy and sale.

The pipes in the cellar, however, with the valves attached to them, the trap and regulator, the risers and distributing pipes, were held to be so perma-

nently annexed to and part of the realty as not to be subject to levy and sale as personalty apart from the realty. National Bank of Catasaqua v. North (1894) 160 Pa. 303. The court said:

"That a steam-heating apparatus is indispensable to the occupancy and enjoyment of a dwelling house as such cannot be pretended. That it is a convenience whose presence may enhance the rental value and the comfort of a house may be very true: See Jarechi v. Phila. Soc'y, 79 Pa. 403, 405. That, as a means of heating dwellings, it will in a short time be superseded by something superior to it, seems but a reasonable expectation. Of no such appliances can it be said that they are of such a nature or character as to be necessary to carry out the obvious purpose for which the building was erected, permanently to increase its value for occupation and use, or to constitute lasting accessions to the property. The same considerations of personal comfort, convenience and safety that call for their adoption at one time will require the discarding of them later on. So far as they consist of movable articles merely standing upon the floors, though screwed to pipes, in walls or under floors, their relation to the realty itself is not different from that of any other sort of detachable heating apparatus, from a portable furnace down to a gas stove, and the consequences of their severance from the realty are precisely the same in kind. There is, in a word, nothing in the act of introducing such articles into a dwelling house, and nothing in their nature, object, purpose or relation to the house, which can give rise to an inference that they were put there to be a part of the realty, or to increase the security of its mortgagee. There is certainly no more reason for indulging such a supposition with respect to such than with respect to gas fixtures. Steam heat is furnished to houses by steam heating companies in the same way in which gas is furnished by gas companies."

COURT HOLDS RADIATORS AND VALVES REMOVABLE

The court concluded that "the only portions of a steam-heating apparatus in a dwelling house that do not ordinarily become part of it in such a way as to prevent their being separated as personalty from the real estate, are the radiators with the valves attached to them. Whilst the traps, regulators, service and distributing pipes, risers, and the valves belonging to them may fairly be considered as necessary to the completion of a modern dwelling house where the facilities for steam-heating exist, and must, in the nature of things, be substantially the same in every case, varying only in dimensions, the radiators with their valves are put up in more or less expensive style, according to the taste and means of the person who intends to occupy the house, or according to the purpose for which it may be designed, as a dwelling for his own family or as a house to be rented to others." Therefore, the radiators and their valves and they alone, it was held, must be regarded as not intended to be annexed to the realty.

A building erected by the Chicago Exhibition Company, with its appurtenances, known as a boiler-house and heating plant, to be used in connection with another structure, then occupied by the company, known as the "Coliseum," the boiler-house being constructed of brick on a foundation of stone and cement, and extending 12 ft. below the surface, contained, as part of the heating plant, four boilers with six fireboxes permanently and substantially attached to the freehold, furnaces, casings, doors, flues, pumps, pipes, condensers and other machinery and equipment, all used in connection with the heating plant. Connected with the building was a brick and cement chimney stack, about 180 ft. high. The Illinois Supreme Court held, Williams v. Chicago Exhibition Co., 188 Ill. 19, that the building, with the boilers, machinery and chimney, was a fixture, permanently attached to the premises. The removal thereof would have amounted to a waste of the premises which the mortgagee was entitled to prevent by injunction, inasmuch as his security would be impaired thereby.

In Scottish American Investment Co. v. Sexton, 26 Ontario Rep. 77, a warm-air furnace attached to the floor of a dwelling house by screws by the mortgagor was held part of the realty as between mortgagor and mortgagee.

In Manning v. Ogden, 70 Han (N. Y.) 399, whether hot water boilers and radiators were fixtures or movables as between real estate mortgagees and chattel mortgagees, was held to depend upon when and how they were attached to the house.

This was also held as to steam radiators in Hook v. Bolton, 199 Mass. 244.

(*Next month*: "*As Between Landlord and Tenant.*")

Legal Decisions

School Board's Power to Provide for Heating Schoolhouse

The North Dakota Supreme Court holds, Ellingson v. Cherry Lake School Dist. 212 N. W. 773, that the board of a common school district has power to contract for the remodeling of an existing schoolhouse so as to provide for the heating thereof, under its statutory power to make necessary repairs and furnish fuel and necessary supplies, without submitting the proposition to the vote of the electors of the district.

Preliminary Injunction Against Strike

An Ohio corporation manufacturing heating and ventilating apparatus and equipment operates its factory at Columbus as an open shop. It installs its plants in Pittsburgh and vicinity by its own erection force, located in Pittsburgh. The members of that force are members of a union. They have no connection with those employed in the Columbus plant. While the company was installing heating and ventilating systems in various school buildings in Pittsburgh, its Pittsburgh employees were called out by their union, and a general strike was threatened if the company continued to attempt to carry out its contracts. There was no controversy over the terms or conditions of employment between employer and employees, either at the Columbus plant or in Pittsburgh. It was conceded that the sole purpose of withdrawing the men from the Pittsburgh shops was to compel the unionizing of the Columbus plant. The federal district court for western Pennsylvania held that, under the Sherman Anti-Trust Act and the Clayton Act, the company was entitled to a preliminary injunction, which was granted.—Columbus Heating & Ventilating Co. v. Pittsburgh Building Trades Council, 17 Fed. (2d) 806.

Substantial Performance of Contract to Install Heating System

Substantial performance is performance where the deviations from the contract provisions are minor, unimportant, inadvertent and unintentional. The doctrine of substantial performance has no application where there is an intentional, deliberate and wilful departure from the contract. Where a contractor, whose contract required that he install eight radiators, installed only seven, leaving the bathroom without any provision for heat, and also wilfully removed the doors and other fixtures from the furnace, and installed, contrary to agreement, a second hand bath tub and wash basin, the New York Appellate Division held, Cramer v. Erswein, 220 N. Y. Supp. 634, that he had not substantially performed his contract.

All-Welded House Heating System

AN interesting comparison of a house-heating hot water system, installed in the usual way, compared with one in which all of the pipe joints are welded, is given in a recent issue of the *Acetylene Journal*.

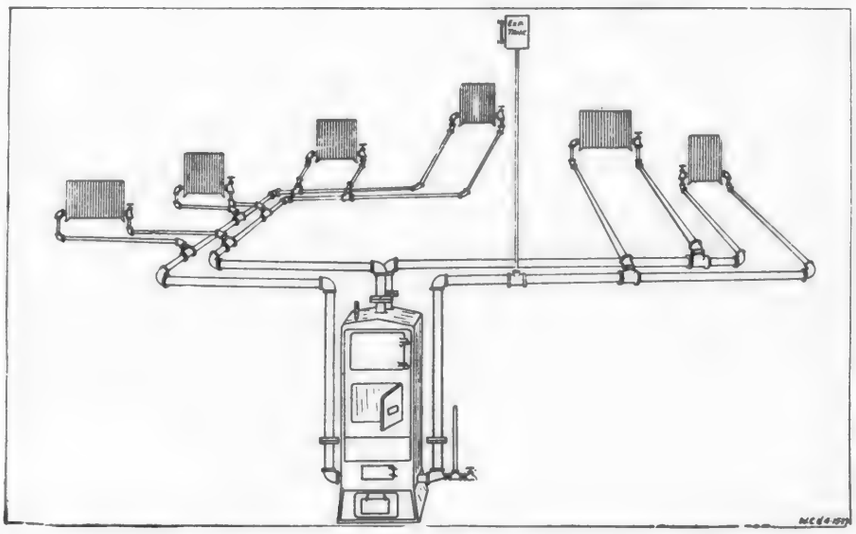
In this case the owner of the building happened to be a welder. His work had taken him to a great many different kinds of buildings and acquainted him with the economies enjoyed by firms who substituted welding for fitted joints in various kinds of pipe line installations. When the question of heating his own home came up, he determined to find out whether he could save any money and get a satisfactory heating plant by welding instead of using threaded joints. He purchased from a large supply house a complete hot water system, including boiler, radiators, pipe, fittings and gauges. A contractor estimated the cost of installing this heating plant at $100. Being familiar with the cost of welding, he estimated that he could not lose very much money by going ahead with his plan to weld the entire system and his experience proved that he actually saved money by throwing away all of the fittings and installing his heating plant by means of welded joints.

His first procedure was to make definite plans for the substitution of welded joints for screwed fittings. Reference to the two drawings will show clearly to what extent the installation was simplified in design. In the first place a number of 90° and 45° elbows were entirely eliminated by heating the pipe with the oxy-acetylene torch and bending it to the required angle. The welder used his torch to attach an ordinary cross coupling to a piece of ¼ in. scrap steel plate. A plate was screwed to a column in the basement and proved a handy method of making the bends.

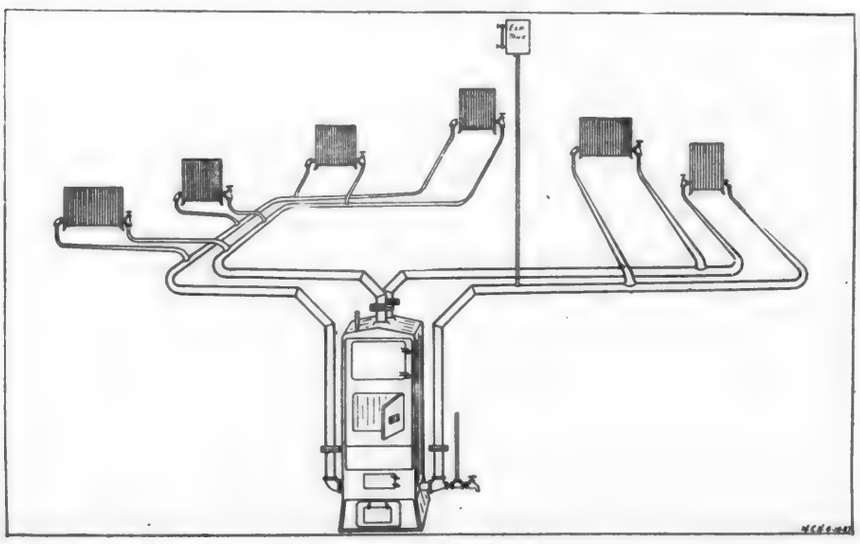
The accompanying photograph shows the appearance of these bends when finished, both inside and outside. The long sweeps, the large radius of the turns, and the smoothness of the interior, all stand as improvements of the fitted systems, because they provide a so much smoother flow of the water in the system. Another point in favor of the pipe bending is that a very slight bend will serve to get around a difficult corner, or carry the line over or under another pipe in the system, under circumstances, which with fittings would require cutting and threading for an elaborate collection of fittings.

Another interesting feature of this installation is illustrated in the arrangement near the top of the boiler. Here the turn has been made by welding a long section of pipe, instead of by using a 90° below. There was no gain in the number of joints because two welds have been used to replace two threaded joints. There is, however, a distinct improvement on account of the wider curve and consequent easier flow of water at these points.

The big saving of time has been made in the places where T-joints were necessary. References to the diagram and also to the photograph will show that a single weld has served the purpose of eliminating a T-fitting, with its three threaded joints. The photograph also shows how simple a matter it is to reduce the size of a pipe by heating and hammering down a large pipe than butt-welding the smaller pipe. In the construction of this heating plant there were 23 welded joints and it was necessary to heat and bend the pipe at 34 places. This made it possible to eliminate 117 screwed connections and 53 assorted fittings.



Layout of Water Heating System as Made Up with Screwed Fittings



Layout of Water Heating System as Made Up with All-Welded Joints

The materials used were about fifty cents' worth of welding rod, one small tank of acetylene and one 220 cu. ft. tank of oxygen. The total time required for the installation of the complete system, including the making of the connections to the boiler, setting up the radiator, etc., was 33 hours for one man. This man was not a steam fitter; just a welder making an experimental installation of a welded heating system.

It is not generally considered desirable to treat this class of work as a job for the ordinary commercial welding shop. A great deal of time certainly can be saved on such installations if the work is done by a steam fitter, who is thoroughly familiar with all of the principles of pipe line work and at the same time has developed sufficient skill in welding to be able to do satisfactory work on small diameter pipes.

This installation has been in operation during the past winter. As far as efficiency is concerned, the owner considers it superior to any hot water system he has ever seen. The water temperature can be raised from 60° to 120

Views of the Welded Joints Showing Long Sweeps, Simplified Tees and General Neat Appearance of the Welded System

F. in 26 minutes and the house temperature from 50° to 70° F. in 40 minutes. No leaks or similar troubles of any kind have developed and he still has left a bushel basket full of fittings.

Thermic Units For Preventing Water Hammer

As an example of the powerful effects which can be produced by water hammer when a healthy steam pressure is turned into a cold system, the amusing story is related of a laundry engineer in a Chicago laundry who got up a full head of steam and opened the main valve one frosty morning a few years ago and then locked up the plant and went across the street for his breakfast. When he returned to the plant, some minutes later, he was surprised to find one of the large mangles, situated in the front of the plant, making an unescorted exit through the front door, accompanied by the powerful pound of a heavy water hammer.

Investigation proved that a peculiarity of the piping system had resulted in the force of the water hammer being brought to bear in such a direction that each time a column of water hit the mangle it was shoved along the floor 5 or 6 in. Due to the fact that the steam connection was long enough to bend, it had not broken and so had enabled the mangle to travel a distance of several feet and half way out the door of the plant.

The problem of warming up a steam system quickly and at the same time safeguarding the piping and equipment from the destructive effects of water hammer is one of the most annoying details of the plant engineer's job. The conventional method of by-passing all steam traps is effective, but it involves not only the loss of considerable time and work on the part of the engineer but the loss of considerable live steam as well.

A recently-developed method makes use of so-called thermic units, which provide an automatic means of holding steam traps wide open until steam temperatures have been established. This device comprises a thermic unit which has been extensively used in effecting heat-regulated control on many kinds of automatic apparatus. It consists of a strip of metal made of laminations which cause it to bend when it undergoes temperature changes.

This unit is applied to the float of the steam trap in such a manner that when the trap is cold the laminated strips hold the valve of the trap wide open. As soon, however, as the cold water and air contained in the line has blown through the open valve, the temperature in the trap rises and expansion of the laminated strip causes it to bend so that it no longer holds the trap valve open but permits the float and lever system of the trap to function in the normal manner. The device usually is set so that as long as the temperature is below 200° F. the valve is held open, while at all temperatures above this point the trap functions in the normal way.

The thermic unit is entirely contained inside the steam trap and becomes an integral part of the mechanism. Due to its simplicity the cost of the entire unit is generally less than that involved in the installation of an adequate by-pass and so, in addition to the economy effected in steam saving and saving due to the elimination of water hammer damage, as well as the saving of the engineer's time, a distinct economy is effected both in installation costs and operation.

The unit is manufactured in a variety of sizes by the Armstrong Machine Works, Three Rivers, Mich., which is its originator, and is available as standard equipment on all its traps or is furnished separately for installation on Armstrong traps already in operation.

New York Chapter Year Book

New York Chapter's Year Book for 1926-1927 is out, containing an account of the formation of the chapter in 1911, the "Engineers' Code of Ethics," officers of the chapter from 1911 to date, membership list and constitution and by-laws. The membership list contains 220 names.

Health and Ventilation

By Peter H. Bryce, M. D.

3. Heating and Ventilating a Unit Dwelling-House

HAVING insured the proper placing of my unit dwelling, 40 ft. long by 30 ft. wide and 25 ft. high in the walls, with its long side looking to the south-south-east, on a well-drained location, and with windows having all air spaces around the frames tightly closed with mineral or asbestos wool, and having outer windows with iron frames and closely-fitted inside ones, as well as doors with weather-strips, we may proceed with the heating and ventilation of a definite cubic air-space within walls whose loss of heat in zero weather can definitely be estimated.

It would be useless to attempt to select from the many systems of heating illustrated in THE HEATING AND VENTILATING MAGAZINE'S advertisements any one in particular; but, should my readers agree with me on what is required, they will be able to determine which advertised system approximates most closely the ideas herein expressed.

Whatever type of heating should be determined upon, it ought to have two or three chief factors to be considered, (1) healthfulness, (2) convenience, (3) economy. In the climate of Ottawa, Canada, 45°50′ north latitude, usage has established hot-water as the most approved heating medium with radiators in every room sized according to the area and exposure of each room. Assuming the radiation to be scientifically estimated, the size of the water heater usually is made sufficient to keep an anthracite coal fire partially banked, except in very cold weather. Thus a really adequate heating system is assured with probably 50% of the heat units of the coal utilized. Within the past few years, however, uncertain supply and the high cost of anthracite have driven householders to try coke, oil, and soft coal as fuels, and various degrees of success have been obtained. But soft coal is disliked because of its dirt and dust, coke requires much attention, while oil is often spoken of as expensive.

With a view to supplying the young and inexperienced householder with safe directions, I propose what practical experience and scientific knowledge indicate as a sanitary and economical method of househeating and ventilation.

In the accompanying diagram is shown a house interior, whose cubic area is estimated at 30,000 cu. ft. which must have its air maintained at 67° F. during the waking hours and supplied with moisture to maintain a relative humidity of 50%. For ease of estimation I shall speak of house air as normal at 70° F. and having a relative humidity of 50%. It will be seen that I have placed the boiler room in the middle of the space in the basement as most convenient and effective. The heating is to be hot water from a heater supplied with an oil burner or a coal self feeder suited to anthracite pea-coal or to ordinary chestnut.

Having determined on the hot-water type of heating, I propose the first radical economy by assembling in a separate room-space, adjoining the heater, with its walls and ceiling constructed of hollow tiles well lined with smooth magnesite plaster, all of my water radiators, instead of placing them with an expensive pipe system in the several rooms.

I have now provided what may be called our "operating room," where it is

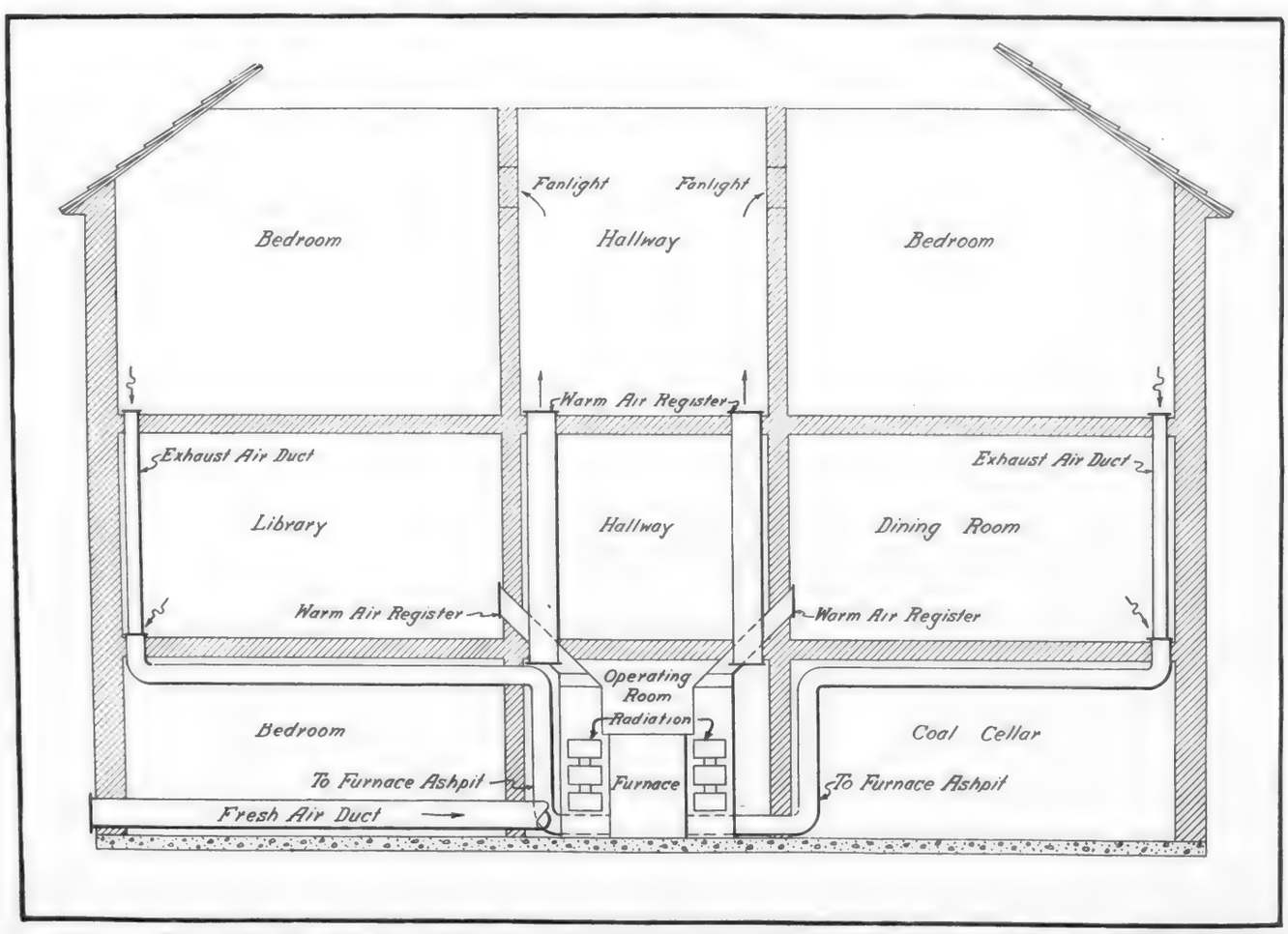


Fig. 1. General Design of Proposed Residence Warm-Air Furnace System (Vertical Cross Section on Long Side), Showing Arrangement of Furnace and Operating Room.

proposed to insure at all times a normal air, to be supplied to all the rooms of the house, through utilizing the laws of the expansion and diffusion of gases. It is obvious that if the heater supplies radiators, through a short and rapid pipe circulation, with all the heat which would have been carried to room radiators, our problem remains one of distributing rapidly and equably the warm air to every room. The system of distribution is that commonly employed in the heating of large churches, theatres and schools, where fans are employed, sometimes supplemented by radiators for direct heating; the common warm-air furnace in small dwellings is an illustration of the same principle.

The diagram shows typical short air ducts to two of the four ground-floor rooms, leading from the inner walls of the operating room to supply warm air directly. Similar ducts lead to the other two ground-floor rooms and to the basement rooms, while two large vertical ducts lead to the second floor and deliver warm air to registers in the upper hall to the amount required for the whole floor.

To obviate any fears regarding the distribution of heat to the several rooms, each door opening on to the hallway should be supplied with a fanlight over it. By this simple means air will reach each room if it is aided by a system of exhaust pipes in the outer corners of the four corner rooms.

It is years since the writer was asked to solve the problem of heating an old-fashioned meeting-house where the warm air rushed toward the 30-ft. space in the gables of the roof. He did so simply by placing registers in the floor at the four corners of the building and leading pipes from these registers to the ashpit of the furnace. Similar difficulties exist in heating the north rooms of houses with the ordinary warm-air furnace when a north wind blows, as illustrated in a recent article in this magazine; the wind driving at an angle past the house cools the air unduly.

CREATING PARTIAL VACUUM BY CONNECTING RETURN AIR DUCTS TO FURNACE ASHPIT

The remedy in each of these cases depended upon the utilization of the diffusion of gases and in lessening the air-pressure by tending to create a vacuum. Thus, if air in a room has a normal barometric pressure of 30 in. and an opening is made at the floor and air extracted, the beginning of a vacuum is created and the cold air at the floor is set in motion, just as is illustrated daily when the wind blows from all directions toward a storm-area of low pressure.

Our diagram shows, in the outer corner of the rooms outlet ducts near the floor, which lead to the basement and into the ashpit of the furnace itself. The air from unoccupied rooms, if further economy is thought worth while, may be directed into the operating room.

Having now secured a means of heating the house properly, we are in a position to refine, so to speak, the house-air. Our first problem is, how are we to insure the adequate amount of moisture to the air in all parts of the house cheaply and automatically? Fortunately, the physical laws governing the atmosphere supply us with remarkably simple means. In Table I is shown the amount of moisture required for each cubic foot of air at different temperatures.

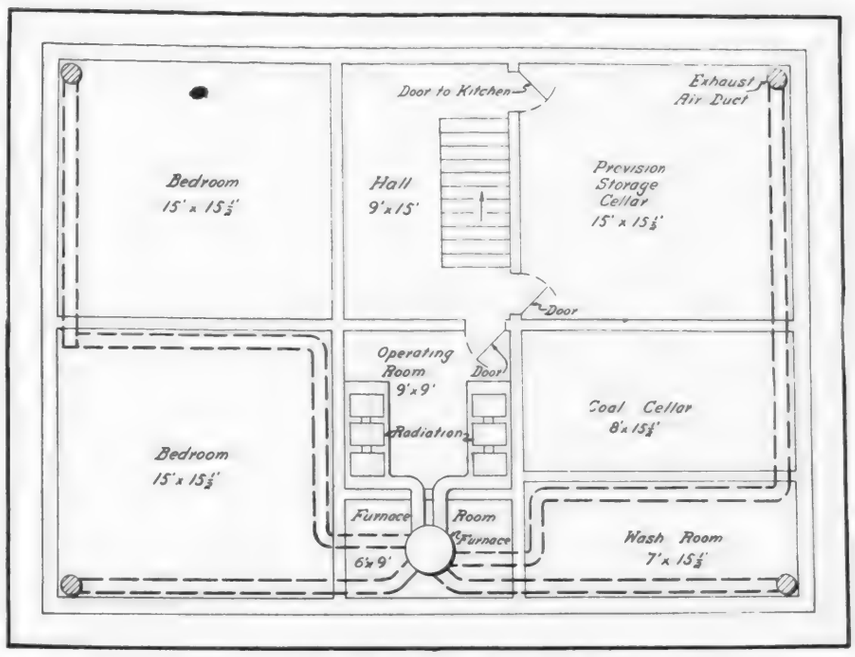


Fig. 2. Sketch Plan of Basement

TABLE I. WEIGHT OF WATER IN GRAINS PER CUBIC FOOT OF SATURATED AIR AT DIFFERENT TEMPERATURES.

Temperature Deg. F.	Water in Grains
—10	0.35
0	0.54
10	0.84
20	1.30
30	1.97
40	2.86
50	4.09
60	5.76
70	7.99
80	10.95
90	14.81
100	19.76

In Table I is given the amount of water in grains per cubic foot that the atmosphere can hold at various degrees of temperature. From this it is apparent that if outside air at zero can hold only 0.50 grains of water per cubic foot, some definite means must be supplied to increase the moisture in such air in winter when it is introduced into our houses. Roughly, the capacity of air for moisture doubles with every 20° increase of temperature; so that at 70° F. a 1 cu. ft. of air can hold 8 grains of water as vapor. Thus, in a house with 30,000 cu. ft. of air-space about 1 gal. of water should be evaporated hourly to supply a relative humidity of from 50% to 55%. Since the amount of moisture, at low temperatures, is so small, an apparatus set to supply this amount by evaporation need not be altered ordinarily when the temperature rises somewhat. This result is obtained by using an apparatus which will insure, by a float or other means, a constant supply of water to an evaporating pan, or a water-tube over the fire in the heater. For years the writer has got good results with such a water-tube over the fire; but it transmits the noise of boiling water to some extent, a sound unpleasant to some, which may be wholly avoided by an electric heater on which is placed a shallow copper pan kept covered with a thin film of water by an automatic supply valve. This heater which, in our unit dwelling of 30,000 cu. ft., must evaporate 1 gal. of water per hour should have 3,000 watts of electricity, and though electricity may cost more than in Ottawa, nevertheless it is an economy because every unit of heat utilized in making steam goes directly into the volume of ascending air

TABLE II. RELATIVE HUMIDITY OF AIR IN PERCENTAGE OF SATURATION

Difference between Dry and Wet-Bulb Thermometer Deg. F.	Air—Temperature Deg. F. 30	40	50	60	70	80
6.5	31	45	58	65	70	74
7.5	27	35	41	52	60	66
9.0	7	26	41	50	57	62
10.0	—	22	38	48	55	61

to the rooms of the house. It is further found in practice that such an evaporating pan will deliver 12,000 cu. ft. per hour of warm saturated outside air. Thus, we have, as a result, air ascending through the ducts to the rooms, not only because of the expansion and diffusion of warm air, but also because the steam actually creates, with the outdoor air, a plenum or air under pressure, which directly assists in the diffusion of the warm air throughout the house. It is obvious that a duct, with a damper, of a foot square area leading from outside will supply air to the operating room at the rate of about 3 ft. per second and should be brought in from the south wall to avoid disturbance through wind pressure.

The operating room should be reached by a door from the hall and not from the boiler-room, and the radiators should be elevated from the floor and away from the walls so that a soft brush from time to time may be used to remove any accumulated dust which by chance comes in through the canvas which should be placed over the inlet-duct. In this way the treated air will be kept clean, will have its proper amount of moisture, and will be kept in gentle movement under a slight pressure, and will at all times be fresh as it is supplied from outside; while the temperature of the air in the rooms will be practically the same, whether at the ceiling or the floor, since all the conditions have been fulfilled.

Little has been said about the heater, but an important point in economy is to insure that the heat units of the fuel be utilized to the fullest extent possible. This may be secured by causing the gases or smoke to pass through small ducts surrounded by hot water in a larger tube placed between the furnace and the chimney and with cleaning doors at either end. The writer has thus saved from the stack gases, in an oil-heated furnace enough heat to raise 150 lin. ft. of pipe to 150° F., which heat can be utilized to heat the water tank for house use or be connected with the general heating system.

The kitchen hot-water tank should be placed in the operating-room and should have its electric heater for summer use. By placing it there it can be utilized on cool evenings to supply a gentle warmth to the whole house air by the simple process of pressing a button in the passageway. Should a special flower-room be desired on the south side of the house, a separate hot-water pipe can be carried from the furnace to heat the benches directly, without disturbing the house heating system.

Such in brief is a modern up-to-date system of house heating, in which due regard has been had for most of the physical laws which enter into the heating problem. Of course, the location of buildings in towns does not make all of these conditions equally available, especially those concerning the question of lighting. In our next article we shall attempt to deal with the lighting problem which is becoming more and more important with the ever-increasing height of buildings and density of population.

Of What Value Are Personal Impressions of Air Conditions?

It is well known that psychology frequently cuts more of a figure in determining proper air conditions in schoolrooms and similar places of human congregation than does physiology; witness the following, from the report on air conditioning in one of the largest public libraries in the country:

"Artificial ventilation in a room with windows closed or in a room without windows will cause frequent complaints. Complaints of poor ventilation stopped after a small flag or string was tied to the duct in a room without windows. Whenever the ventilating fan was stopped for repairs, complaints of headaches were made because the flag or string would hang down. As it became necessary to make extensive repairs to the blowers, the writer secured a fine wire to the string which thus stood out from the inlet or supply duct, as if the moving air held it out. During the week repairs were made, no complaint of lack of air was made. When this became known it was necessary to install a small propeller rotated by the incoming air. Visual evidence of ventilation seems to satisfy."

A. G. A. Compiling Competitive Fuel Data

The American Gas Association is now preparing for the use of its members a series of confidential information sheets on the developments in the use of fuels now in competition with gas for industrial and factory heat operations.

A wealth of valuable information, including comparative data, results of tests, etc., on all developments of a competitive nature, will soon be on hand as a result of the work done by the committee on competitive fuels, of which R. H. Staniford, of The Brooklyn Union Gas Company, is chairman. This is a committee of the Industrial Gas Section of the A. G. A.

Direct-Fired Unit Heater Shows High Heating Efficiency

An interesting example of the adaptation of electric fans to warm-air heating plants and the use of such a combination as a unit heater is furnished in an installation in a foundry of the Fuller-Warren Co., Troy, N. Y. The computations on this building show the following:

Cubic contents	155,000 cu. ft.
Exposed wall	8,443 sq. ft.
Roof	7,874 sq. ft.
Window	923 sq. ft.
Skylight	324 sq. ft.

Using conventional constants, the B.T.U. loss from this building, for a 60° F. temperature rise, is approximately 639,300.

The equipment consists of a heavy-duty Miles automatic furnace-fan attached to a No. 26-54 Stewart heater, with a Miles draft attachment. The operation through the past heating season is reported to have been very satisfactory, with no forcing of the unit in spite of the fact that the grate area is only 3.5 sq. ft.

To furnish the computed B.T.U. it would have been necessary to maintain a register temperature of nearly 150° F., and, as 130° was the maximum required, it is fair to conclude that this method of heating, where the warm air is delivered reasonably near the breathing line, requires less heat than is indicated by conventional computations.

It is stated that the Fuller-Warren Company is discarding the exhaust-steam heating in its other buildings in favor of similar direct-fired units.

A Foundry Successfully Heated with a Direct-Fired Unit Heater

Correspondence

Conducted by T. W. Reynolds

Capacity of Steam Mains Above 20 In.

EDITOR HEATING AND VENTILATING MAGAZINE:

Are there tables or formulae giving the capacity of steam mains up to 30-in.? Such tables as I have seen do not go above 20-in. Possibly it is not good practice to use larger sizes of pipe on low-pressure systems.

Sheboygan, Wis. EDWIN E. GRAFF.

Manufacturers' tables of commercial pipe usually list the sizes only up to 15-in. or 20-in. because of the slight demand, comparatively speaking, for pipe of larger size, known as O. D., or outside diameter, pipe. Hence, the largest size tabulated becomes a convenient stopping point for the compiler of steam-flow pipe tables. Furthermore, the thickness of the pipe in the smaller sizes is standardized or known, whereas in the larger sizes it is made to order in accordance with the purchaser's specification. As the actual internal diameter of the pipe enters into the formula, affecting the amount of steam delivered, it is apparent that the compiler of the tables in question would not know just what values to list.

Again, such large pipes are generally used only for main distribution within the power house, so that the matter of pressure drop (vital to small pipes in heating systems), does not enter into the problem. The pressure drop, within limits (according to the case), can be anything from the initial pressure down to say, zero gauge pressure. For example, at 5 lbs. initial pressure, the pressure drop could be 4½ lbs., leaving a terminal pressure of only ½ lb., just enough to have some pressure for delivering the steam at the terminal point. Of course, at the same time, the pressure drop must not go above the point at which the velocity of steam flow would exceed limitations for proper drainage.

The Unwin formula is probably the most widely used, but like all formulae, it is difficult or laborious to work out. The following table, compiled in part by W. L. Durand in order to overcome this difficulty, has been extended to include the larger sizes of pipe mentioned. Any part of this table can readily be extended even further, as the formula, when separated into the three parts shown, is easy to apply.

In computing the proper size of steam pipe both the pounds of steam to be delivered at a certain pressure and the drop in pressure possibly are generally known. Under these conditions, the table would be used as follows:

Assume, say, 6 lbs. of steam per minute at an initial pressure of 5 lbs. and a total pressure drop of 3 lbs. for a run of 300 ft., or, what is the same thing, a 1-lb. drop per 100 ft., for it should be noted that the values in Column 2 are only for a run of 100 ft. The values in Column 6 should be taken for the mean or average pressure between initial and terminal pressures.

For the given conditions of 5 lbs. initial and 2 lbs. terminal, the values selected in Column 6 opposite these pressures in Column 5, would be 0.222 and 0.205, or 0.213 for the average of the two. Multiplying this value by 8.7, as selected from Column 2 opposite 1 lb., gives 1.85 which, divided into 6, the pounds of steam to be delivered, equals 3.2. The nearest value to this in Column 4, higher in amount, is the one opposite the 2-in. diameter in Column 3. This is the size of pipe required.

To know the velocity of steam in order to keep it within certain limitations, multiply the 6 lbs. of steam to be delivered, as previously assumed, by the number of cubic feet each pound occupies at the given pressure. At 5 lbs. pressure this is 20.38, as may be determined from any table on the properties of steam. The product of 122.3 divided by 0.0233, the actual internal area in square feet of the 2-in. pipe, gives 5250 ft. per minute as the velocity within the pipe. The pounds of steam delivered at the 2-lbs. pressure will be $(6 \times 20.38) \div 23.8 = 5.16$ lbs.

The Unwin formula is as follows:

$$W = \left(87\sqrt{\frac{P}{L}}\right)\left(\sqrt{\frac{d^5}{1+\frac{3.6}{d}}}\right)\left(\sqrt{D}\right)$$

W = Weight of steam passing in pounds per minute.
P = Drop in pressure in pounds per square inch.
L = Length of pipe in feet.
d = Actual internal diameter of pipe in inches.
D = Average density or weight of steam per cubic foot.

Note:

Column 4 is for use with standard-weight pipe.

Extra-strong pipe in the same sizes has less internal area.

Sizes 4½, 7 and 9-in. and the lighter weights of 8, 10 and 12-in. have not been used in the table, as the manufacturers have discontinued the manufacture of these weights and sizes. Formerly there were two different internal diameters for the 8 and 12-in. sizes and three for the 10-in. size.

Actual internal diameter of the pipe is nearly that of the nominal diameter, the size by which the pipe is generally known or spoken of, for most sizes the internal diameter being slightly larger. Above 12-in. the nominal size is the same as the outside diameter, hence the name of O.D. pipe for the larger sizes, the internal diameter varying according to the thickness specified in the order. The usual thicknesses are ⅜-in. for sizes 14 to 26-in. and 7/16-in. for the 28 and 30-in. sizes. These thicknesses have been assumed for use in extending the table for sizes over 12-in.

Calculated capacities for the smaller sizes in the table should be reduced about 20% to allow for entrained water and condensation and for roughness and lack of reaming of the pipes.

Tabular Values of Quantities in Unwin Formula for Flow of Steam in Pipes

1	2	3	4	5	6	3(Cont.)	4(Cont.)
Drop in Pressure per 100 Ft.	$87\sqrt{\frac{P}{100}}$	Normal Diameter of Pipe In.	$\sqrt{\frac{d^5}{1+\frac{3.6}{d}}}$	Steam Pressure Lbs. per Sq. In.	$\sqrt{D}$	Normal Diameter of Pipe In.	$\sqrt{\frac{d^5}{1+\frac{3.6}{d}}}$
1 oz.	2.17	¼	.117	0	.193	18	1125
0.1 lb.	2.75	⅜	.266	2	.205	20	1492
0.2	3.89	½	.536	5	.222	22	1924
0.3	4.76	¾	1.178	10	.246	24	2425
0.4	5.50	1	1.83	15	.268	26	2996
0.5	6.15	2	3.71	20	.289	28	3600
0.6	6.74	2½	6.12	30	.325	30	4326
0.7	7.28	3	11.18	40	.357		
0.8	7.78	3½	16.7	50	.387		
0.9	8.26	4	23.7	60	.413		
1.0	8.70	5	43.7	75	.451		
1.25	9.74	6	72	100	.507		
1.50	10.65	8	149	125	.557		
1.75	11.50	10	271	150	.602		
2.00	12.30	12	438	175	.644		
2.5	13.74	14	567	200	.683		
3.0	15.05	16	817				

Threading of Cast-Iron Pipe

EDITOR HEATING AND VENTILATING MAGAZINE:

Why is it that cast-iron pipe is not threaded when we have threaded fittings of the same material?

J. D. M.

For certain classes of service, cast-iron pipe is sometimes furnished with threaded ends. This practice, however, is unusual for cast iron is quite brittle and is weakened by threading. Valves and fittings can be made large enough to compensate for the loss of strength by threading, whereas the necessary increase in weight of the pipe, as required to offset the loss of strength when threaded, would be prohibitive. Furthermore, cast-iron pipe is rarely, if ever, subject to high pressures, so that the usual cup joint or flange joint is entirely suitable. Unlike threaded joints such joints do not need to be turned or screwed into position, consequently they require less labor in installation.

Why We Use Flange Unions Instead of Regular Companion Flanges

EDITOR HEATING AND VENTILATING MAGAZINE:

Why do we have flange unions when we already have regular companion flanges as required for use with flanged valves and fittings? Just where should screwed unions be used and where should flanged unions be used? What are the relative merits of cast iron and malleable flanges? Should flanges be left uncovered when all other hot surfaces of pipe and fittings are insulated?

M. R. L.

In low-pressure heating work it is common practice to use screwed unions for sizes 1½ in. and smaller, and ordinary flange unions* for sizes 2 to 6 in. For large work, regular companion flanges are installed. Such flanges are expensive, as they are heavier, and must be made suitable in every way to the flanges of the valves and fittings which they connect.

A flanged union should make as good a joint (referring to low-pressure heating), or at least as good a joint as desired, as regular companion flanges, even though the latter are heavier and have different boltings. Of course, it depends on the quality of the union, there being three or four grades to every make. For example, in the common flanged union the faces of the flanges are rough, whereas the higher grade and more expensive unions have finished faces, the same as companion flanges.

Screwed unions are also made in various grades—flat-faced requiring gaskets, and ground joints having brass to brass or iron to brass seats. Screwed joints are not so easily uncoupled in a rigid pipe line, so that in such cases it would be better to use a flat-face connection. Furthermore, whenever a screwed joint is remade, care must be taken to prevent injury to the recess and projection of the joint. On the other hand, wherever clearances are extremely limited, it is difficult to withdraw bolts from the flange unions. This type of union has a gasket, which, of course, has to be renewed whenever the joint is remade.

A much lighter-weight fitting can be made with malleable iron than with cast-iron and still stand the same pressure. This is because the tensile strength of malleable iron is almost 50 per cent greater than that of cast iron.

Loss of heat from uncovered flanges may be greater in amount than usually considered. There is often about as much exposed surface in a pair of uninsulated flanges as there is in the body of a fitting. Although covering of these surfaces is usually done for reasons of economy, an additional benefit is obtained by their insulation, preventing leaks through reduction of the expansion and contraction which would result from bare surfaces.

*This refers to special flanges which come bolted together in pairs. Two standard companion flanges also may be bolted together on the job. Specifications should be specific on this point.

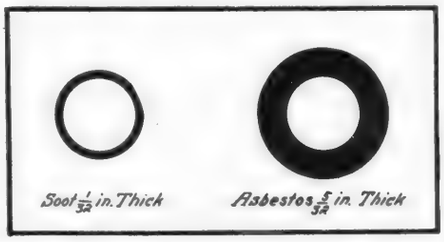
What Soot Does to the Coal Pile

EDITOR HEATING AND VENTILATING MAGAZINE:

I desire information concerning the approximate loss of heat units due to accumulations of soot in the smoke flues and passages of cooking stoves and ranges, and in heaters where wood, soft coal and other soot-producing fuel is used. Can you give me this information or direct me to the proper source to obtain it?

Cincinnati, O. M. P.

The loss in conductivity of boiler plate due to different thicknesses of soot deposit, according to the Proceedings of the Institution of Marine Engineers, January 6, 1908, is as follows:



Comparative Thicknesses of Soot and Asbestos for Equal Insulating Power

Thickness of Soot, In.	Loss, Per Cent
Clean Plate	0.0
1/32	9.5
1/16	26.2
1/8	45.2
3/16	69.0

Kent, in his "Mechanical Engineer's Pocketbook," gives the number of pounds of water heated 10° F. by a temperature of 310° F. applied to 1 sq. ft. of asbestos and loose lamp black (soot) 1 in. thick as 49 and 9.8, respectively.

As will be noted from the above, soot has five times the heat-resisting power of asbestos. This would seem to indicate that a layer of soot 1/32 in. thick causes a condition of inefficiency equal to covering the tubes with a layer of asbestos 5/32 in. thick.

Tests on power boilers often show a saving of from 5% to about 20% due to the installation of mechanical soot blowers. As for sectional heating boilers, some householders who keep an accurate record of coal consumption and clean their boiler once each month, claim that about 50% more coal is burned in any month that the boiler surfaces are not cleaned of soot; in fact, it only takes a few days after cleaning for the effect of soot to become noticeable. This is probably due to the low velocity of gases and the large amount of horizontal heating surfaces.

Burning of salt in the furnace will be of help in cleaning the surfaces, and as for the sooting up of the basement, this need not be so bad if the householder will remember to keep the draft damper open while cleaning out the boiler.

Cross Connecting Mains at Their Ends

EDITOR HEATING AND VENTILATING MAGAZINE:

Do you advise the use of equalizers for cross connecting two steam mains at their ends?

B. J. M.

The advantages obtained by the use of equalizers outweigh any of the possible disadvantages. For example, a main near its end may have a greater drop in pressure at all times or part of the time than the end of some other main. As a consequence, the main having the greater pressure drop will warm up the radiation which it supplies at a slower rate, or possibly not at all, whereas equalizers establish the same pressure in each main; therefore, the rate of heating throughout the system is more uniform.

Any disadvantage due to the use of equalizers would be that as caused by steam reaching the end of one steam main before the other, in which case it might flow by cross connection to the other main and pocket condensation between itself and the steam advancing more slowly by the other route, thus causing water hammer and surging. This, at the worst, should be but a temporary condition, or in any event, it is one that easily can be remedied by the mere closure of the stop valve with which the equalizer should previously be equipped. It is also necessary to connect the equalizer from the top of each main so as to prevent any possible interchange of condensation. Incidentally, equalizers are sometimes used in water-heating work, as well as in steam heating.

Compressing Low-Pressure Steam for Process Work

By Norman W. Calvert

(From a report presented at the annual convention of the National District Heating Association, in West Baden Springs, Ind., May 17-20, 1927).

ONE of the factors most difficult to contend with in low-pressure district heating work is the demand for high-pressure steam for laundry, cooking and process work. It has been demonstrated successfully time and again that cooking may be done with steam pressures as low as 5 lbs. gauge, and while laundry and other equipment may be operated at pressures of 25 to 30 lbs. gauge, there is a material sacrifice in efficiency because of the lower temperature of the steam.

In seeking to eliminate this loss of efficiency, the idea was conceived of compressing low-pressure steam, thereby increasing the pressure and temperature. An experiment of this nature has been undertaken in Detroit this year in a laundry which is supplied with central heat. The tests have not been carried far enough to draw authoritative conclusions as to the results, but the subject being of such universal interest, and a number of requests for information having been received, this paper is intended as a progress report showing the trend of results to date.

DETAILS OF EQUIPMENT

The equipment was set up as shown in Fig. 1. An ordinary motor-driven air compressor, size 9½ in. x 12 in., driven by a 60 H.P. motor, was installed which receives its steam supply through main "A" at 30 lbs. gauge pressure. The steam passes through separator "B" and throttling or governor valve "C" into the cylinder of the compressor where it is compressed and delivered to tank "D." The governor valve serves to throttle the flow of steam to the compressor as the pressure in the tank "D" approaches the desired high pressure. Tank "D" is equipped with three safety valves, the first of which, shown at "E," is adjusted to open whenever the pressure on tank "D" should momentarily increase before the governor valve can reduce the steam supply to the compressor, and this safety valve discharges back into the supply main where the excess pressure is quickly dissipated. The other two safety valves at "G" are adjusted to open and discharge to atmosphere, should the tank pressure exceed 100 lbs. The entire system is insulated with 2 in. of 85% magnesia. The thickness of this insulation may have to be increased in order to reduce the high room temperatures now existing around the equipment.

The high-pressure steam is taken from the tank "D" to the laundry equipment, consisting of one American six-roll mangle 9 ft. wide, five pressing machines and one tumbler.

RESULTS OF TESTS

Tests are being conducted by taking records of steam pressure, quality and temperature on supply and discharge sides of the compressor, electric and steam consumptions and quantity of laundry handled by the mangle.

Fig. 2 shows two typical days' pressure, temperature and consumption records with compressor in operation. The steam coming to the compressor is practically dry saturated at 30 lbs. pressure, and, leaving the compressor at about 75 lbs., has 30° to 50° superheat.

Fig. 3 shows the comparative steam consumption for two days, on one of which the laundry equipment was operated with a pressure of 30 lbs. gauge, and on the other with steam compressed to 75 lbs. gauge. On these two days the amount of work handled in the laundry was practically the same. The steam consumption, under high-pressure conditions, is about 20% greater than under low pressure, but the speed with which the work could be handled is practically doubled. For example, with 30 lbs. pressure the mangle can be operated at a speed of 35 ft. per minute, whereas with 75 lbs. pressure it can be operated at 65 ft. per minute. The tumbler operation under 30 lbs. pressure requires one hour and a half, whereas with 75 lbs. pressure it requires only 40 to 45 min. Under high-pressure conditions, therefore, the same amount of work could be handled in half the time and the steam consumption should be only about 60% of that required at low pressure. The reason why this result is not obtained at present is because the working force in the laundry is not adequate to maintain the maximum speed possible with the high-pressure steam, and also there are fairly long intervals of time when the ironing equipment is idle because of difficulty in keeping it supplied from the washing machines which are not

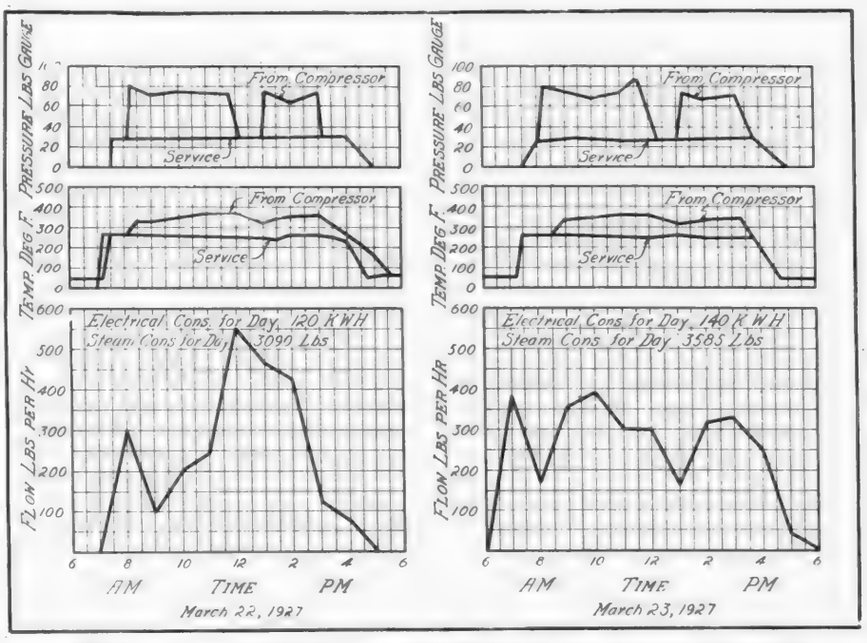

TEMP. DEG. F. PRESSURE LBS GAUGE
From Compressor
Service
FLOW LBS PER HR
Electrical Cons. for Day 120 K.W.H.
Steam Cons. for Day 3090 Lbs
Electrical Cons. for Day 140 K.W.H.
Steam Cons. for Day 3585 Lbs
AM TIME PM
March 22, 1927
March 23, 1927

Fig. 2. Temperature, Pressure and Flow for Two Typical Days with Compressor in Operation

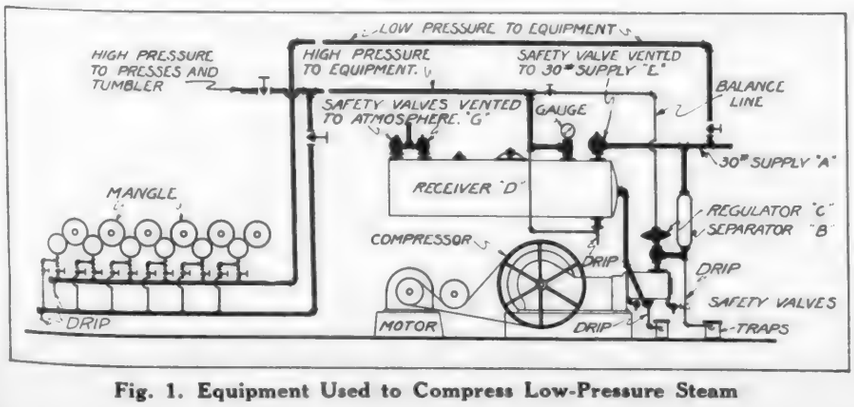


Fig. 1. Equipment Used to Compress Low-Pressure Steam

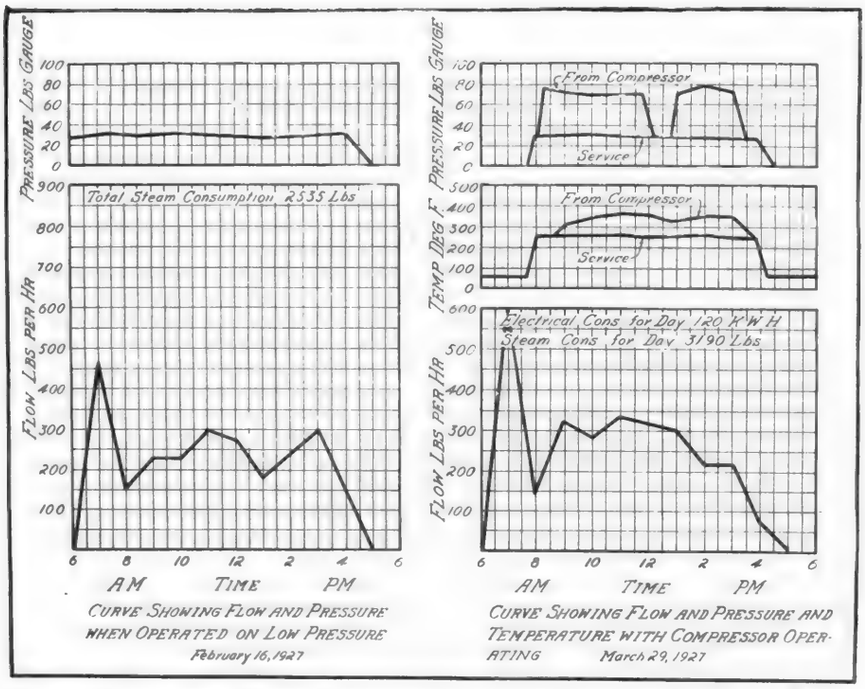

Pressure Lbs Gauge
Total Steam Consumption 2535 Lbs
Flow Lbs per Hr
AM Time PM
Curve Showing Flow and Pressure when Operated on Low Pressure
February 16, 1927
From Compressor
Service
Temp Deg F
Electrical Cons for Day 120 K W H
Steam Cons for Day 3190 Lbs
Curve Showing Flow and Pressure and Temperature with Compressor Operating
March 29, 1927

Fig. 3. Comparative Steam Consumption for Two Days, One Day with Steam at 30 Lbs. Pressure and the Other with Steam Compressed to 75 Lbs.

of sufficient capacity to handle as much work as the ironing machines under high pressure.

Tests are also being conducted to see if it will be possible to obtain satisfactory results by heating some of the rolls with low-pressure, and the others with high-pressure steam, but present indications are that the capacity of the machines will vary directly with the number of rolls using high pressure. These tests are intended to determine whether there can be an appreciable saving made by investment in compressing equipment of smaller capacity.

The results of the tests to date, after about one month's operation, seem to indicate that it is entirely practicable to compress low-pressure steam to any pressure desired for process work. Whether or not compression of steam is desirable from an economic standpoint is a question which must be decided in each specific case where it is contemplated. In the case under discussion the following figures are approximate costs:

COST OF EQUIPMENT INSTALLED

The installation of a compressor capable of compressing 1000 lbs. of steam per hour from 30 lbs. to 80 lbs. gauge, together with all necessary piping, valves, drip traps, etc., for connection to laundry equipment costs between $4000 and $4500. In this particular installation the compressor has been required to deliver only half capacity, or approximately 500 lbs. per hour, totalling 1,000,000 lbs per year.

The current used by the motor on the compressor averages 125 K.W.H. per eight-hour day. These figures may be compared with estimated costs of installation and operation of high-pressure boilers, or of electrically-heated laundry equipment.

While comparative figures would indicate that the installation and operation of a boiler would be somewhat cheaper than the compressor, the intangible values inherent in central services, cleanliness, reliability and convenience, in many cases, will probably overbalance the saving and favor the compressor installation.

Deaths

BRIGADIER-GENERAL GUY E. TRIPP, chairman of the board of directors of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., whose death occurred June 14, at the New York Hospital, New York, following an operation, had long been a prominent figure in the electrical world. During the World War, he was called upon to handle the problem confronting the War Department in the rapid production of upwards of $16,000,000,000 worth of war material. Because of his intimate knowledge of manufacturing and his broad executive experience, he was appointed chief of the Production Division of the Ordnance Department. Mr. Tripp entered the service in January, 1918, as a major in the Ordnance Department and within ten months was made a brigadier-general and assistant to the chief of ordnance of the U. S. Army.

Earlier in his career General Tripp became associated with Stone & Webster, construction engineers, of Boston, and later was made vice-president of the Stone & Webster Management Association and also of the Stone & Webster Engineering Corporation. In 1912, he was selected for the position of chairman of the board of directors of the Westinghouse company. He was 62 years old.

NATHANIEL H. BLATCHFORD, manager of the E. W. Blatchford Co., Chicago, Ill., and a brother of E. W. Blatchford, founder of the company, died June 13 from a heart attack. He was 75 years old.

CLARENCE KNIGHT PRINCE, general superintendent and a member of the board of directors of the H. B. Smith Co., Westfield, Mass., died May 5, at the Noble Hospital, Westfield, after an operation for appendicitis. Mr. Prince was born in South Portland, Me., in 1869, when that town was known as Knightville. He received his education in the public schools in that section and completed it at Worcester, Mass., where he was graduated from the Worcester Polytechnic Institute in 1890. After his graduation, Mr. Prince became associated with the company where he remained until his death. He was a member of the municipal lighting board, of Westfield, and its school committees, and was instrumental in establishing the Westfield Chamber of Commerce.

JOHN MILTON GOODELL, an associate editor of *Engineering News* and a former editor of *Engineering Record*, died June 21 at the French Hospital, New York. He was born in Worcester, Mass., August 3, 1867, and was graduated from the Worcester Polytechnic Institute in 1888, with the degree of bachelor of science in civil engineering. He was well known in the field of highway engineering and waterworks construction and maintenance. After retiring from active work in 1912, he spent much time in writing and also did a great deal of organization work in connection with the building of highways. He was the author of several books on his specialties.

ROBERT A. KEASBEY, president and general manager of the Robert A. Keasbey Co., New York, manufacturer of asbestos pipe covering materials, died June 21 at his home in Roseland, N. J. He was 69 years old. Mr. Keasbey was one of that rapidly-diminishing circle of men who were closely associated with the early development of the heating industry, particularly in the metropolitan district.

LAWRENCE R. LIBBY, president and treasurer of Libby & Blinn, Inc., Hartford, Conn., and a leading heating engineer and contractor of New England, died June 12, at the age of 62 years. Most of Mr. Libby's business career had been as a heating man. As far back as 1887 he was in charge of the heating department of Olds & Whipple, of Hartford. He formed the firm of Libby & Blinn in 1898. Mr. Libby was an enthusiastic hunter. He was also a thirty-second degree mason.

AIR CONDITIONING

Refrigeration Required to Cool Air

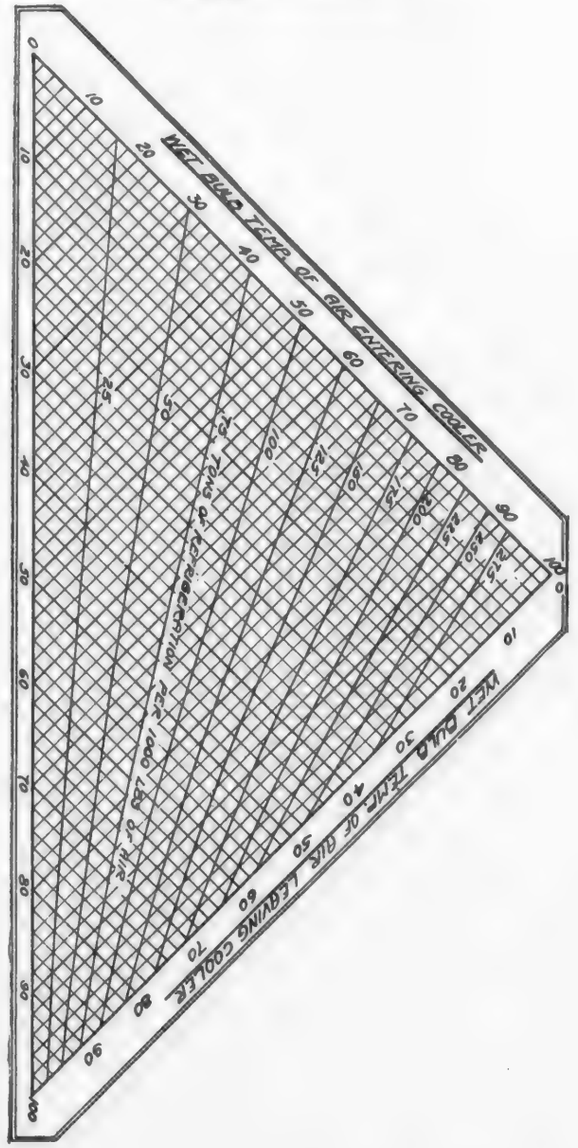
Data Sheet No. 20 gives the quantity of refrigeration in tons required to cool 1,000 lbs. of air from a stated wet-bulb temperature of the air entering the cooler to a given wet-bulb temperature of air leaving the cooler. To find the tonnage required, first determine the wet-bulb temperature of the air entering the cooler and locate this value on the left border of the chart. Pass diagonally downward to the right, along the entering wet-bulb temperature line, to the point of intersection with the required wet-bulb temperature of the air leaving the cooler. The point of intersection of the two lines gives the tonnage required per 1,000 lbs. of air.

Example: A theatre requires 40,000 C.F.M. at a temperature of 60° F. saturated at the cooler outlet. Assume that the dry-bulb temperature of the entering air is 95° F. and the relative humidity 38%. Referring to a Psychrometric Chart, we find that this air has a wet-bulb temperature of 75° F. Volume in cubic feet of 1 lb. of air may be taken at 13.3. Hence, 40,000 C.F.M., divided by 13.3, gives 3,000 lbs. of air. Locate the 75° wet-bulb temperature line on the left border of the chart and pass diagonally downward to the right until the 60° leaving-air temperature-line is reached. At the point of intersection of the two lines read 58 tons of refrigeration per 1,000 lbs. of air. Since 3,000 lbs. of air per minute pass through the cooler, then 58, multiplied by 3, gives 174 as the total tonnage required.

O. W. Armspach

AIR CONDITIONING—How to Use Refrigeration Chart | No. 20A

AIR CONDITIONING



AIR CONDITIONING—Refrigeration Chart for Air Cooling | No. 20

Residence of Don H. York, Washington, D. C.

Heating a Six-Room Residence During Three Winter Months With Two Tons of Coal

By Armin Elmendorf

OWNERS of insulated homes are accumulating impressive data on the economies obtained in heating their homes. The comfort and uniformity of temperature also is frequently spoken of by the people who have built residences in recent years and have incorporated insulating materials in the construction of their homes. Don H. York, who lives near Washington, D. C., has built such a home and has been keeping records from day to day of the exact amount of coal burned in his heater.

This residence is unique in two respects. The leading characteristic of its construction is illustrated in Fig. 2, from which it will be seen that the entire interior is made of Celotex used in its natural color as manufactured. This insulation is applied not only to the exterior walls, but also to the ceilings of both the downstairs and upstairs rooms, also both sides of partition walls. The Celotex boards are inserted into grooves cut into the 2 in. x 4 in. uprights or studs, base and plate, as illustrated in Fig. 3. The exterior of the building consists of a cement asbestos board ¼-in. thick also set into grooves, with an air space of 2 in. between the Celotex and the exterior asbestos boarding. Both the Celotex and the asbestos boards are cut 16 in. wide so that three pieces of this width are obtained from a 48 in. board in which this form of insulation is manufactured. The studding is painted.

Due to absence from his home on some days, Mr. York was unable to obtain a continuous record, but on other days he measured the weight of every shovelful of coal thrown into the furnace. The total weight of coal burned on each day on which the record was taken is given in Table 1. The average outside temperatures and the average inside temperatures on each of these days also was included in this table.

TABLE I.—TYPICAL DAILY RECORDS OF COAL BURNED

Date	Average Temperature Outside, Deg. F.	Average Temperature Inside, Deg. F.	Temperature Difference Deg. F.	Coal Burned, Pounds
Jan. 15	27	68	41	80
16	18	65	47	41
17	23	65	42	57
18	31	64	33	33
19	38	71	33	32
31	44	69	25	41
Feb. 1	43	70	27	41
10	39	71	32	34
11	39	70	35	47
12	40	67	27	36
13	30	68	38	56
14	41	70	29	31
15	39	70	31	37
16	52	68	16	31
17	53	72	19	24
18	53	70	17	28
19	33	67	34	44
20	30	67	37	28
Average	37	68	31	40

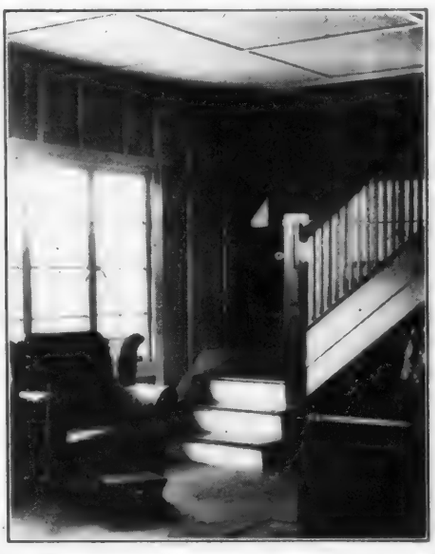


Fig. 2. Interior of York Residence Showing Paneled Celotex Walls

The temperatures at Anacostia Station, where Mr. York's residence is located, are about 4° lower than the average temperatures in the city of Washington. The average outside temperatures on the days in which the coal records were taken are appreciably lower than the general average outside temperatures for these months so that the coal consumed per day during the days in which the measurements were made was somewhat higher than the average daily consumption. It is significant to note from Table 1 that Mr. York burned only 40 lbs. of coal per day during the two coldest months of the year.

The residence has six rooms and there are about 10,000 cu. ft. of room volume that are heated. These and other data pertaining to the tests are given in Table 2. The furnace is a "New Idea" model furnace of 1926, made at Utica, N. Y. White ash anthracite coal, nut size, costing $15.75 per ton, was used. The cost of coal per day during the winter months of January and February was therefore only 32c. The total coal consumed during the three months of December, January and February was less than two tons. The York residence therefore, is a striking example of the economy achieved with board insulation, such as Celotex.

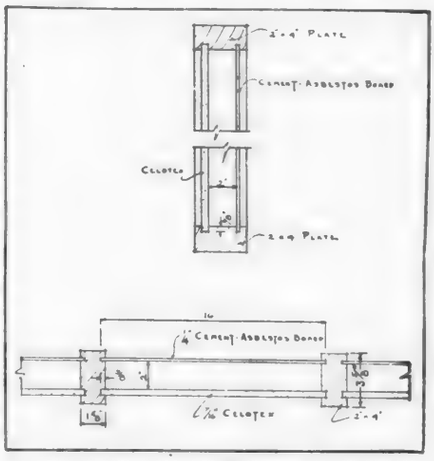


Fig. 3. Section Through Wall of York Residence

TABLE II.—TEST DATA

Number of rooms	6
Volume of rooms heated, total	10,000 cu. ft.
Average coal consumed per day in January and February	40 lbs.
Average indoor temperature	68° F.
Average outdoor temperature	37° F.
Temperature difference	31° F.
Coal burned per degree temperature difference per day	1.29 lbs.
Cost of coal per ton	$15.75
Cost of coal per day during January and February	$0.315

Converting a Manual Commercial Oil Burner to Semi-Automatic Control

A Simple Combination of Standard Control Device, Pressure-Limit Switch and No-Voltage Release Does the Trick

As announced in the April issue of THE HEATING AND VENTILATING MAGAZINE, one of the proposed changes in the 1925 Regulations for Oil Burning Equipment to be shortly revised by the Flammable Liquids Committee of the National Fire Protection Association, reads as follows:

"Immediately preceding the regulations for the Installation of Domestic Oil Burning Equipments (between pages 18 and 19) create a new division to be entitled: 'Regulations for the Installation of Oil-Burning Equipments in Apartment Houses, Public and similar buildings where a competent attendant is not constantly on duty in the boiler room.' The requirement for this new division shall read as follows:

" 'In hotels, apartment houses, office buildings and similar occupancies, where a competent attendant is not required to be constantly on duty in the boiler room, the oil-burning equipment shall be provided with suitable automatic safeguards to prevent abnormal discharge of oil at the burner.' "

It will prove surprising to many to learn that the industrial burner, unless fully automatic, requires the presence of an attendant if the provisions of the 1925 regulations are strictly to be met.

Up to the present time, a rigid interpretation of the regulations has never been vouchsafed in this connection. Yet the recent action of certain cities in passing laws, has brought the whole matter to the attention of the burner and control men.

The proposed action of the Flammable Liquids Committee will recognize an intermediate class of installations between those (industrial) requiring the continued presence of an attendant and those admittedly requiring no attendant at all,—the fully automatic, domestic burner. This immediate class may be styled "semi-automatic" inasmuch as such burners require a certain degree of attendance, yet have automatic features as well.

The twofold purpose of controls is to suit the output of heat to the requirements of the moment on the one hand, and on the other to insure safety against the hazards incident to accidental escape of oil.

Full automatic control supervises the starting and stopping of an oil fire when the needs arise, and puts a definite ban on improper operation. Semi-automatic control regulates a fire after it has been manually started and, like its more ambitious counterpart, stops the flow of oil following a cessation of proper operation before damage can be done or undue hazards imposed upon the property.

Nearly all manually started burners include, as a part of their electrical equipment, a device which will prevent a resumption of burner operation after an enforced stop due to temporary failure of the supply of electrical energy. Others involve apparatus responsive to steam pressure that will check the fire to low proportions after a definite steam pressure has been attained and thus allow the fire to fluctuate between high and low magnitudes as the loads require.

A further extension of semi-automatic control interlocks an extreme-pressure limiting device with the valves and switches which insure positive, permanent stoppage of burner operation, so that if, despite the functioning of the pressure regulating apparatus, the steam pressure continues to climb after it has reached a predefined figure, the burner will be stopped, and can only be restarted by manual means.

Still another semi-automatic provision will cause permanent cessation of burner operation in the event that the oil flame is extinguished (due to any one of a number of causes) while the burner is still fed with its requisite electrical energy and, in fact, is still in motion.

Any or all of these desirable results can be secured without embracing full automatic control, that is, while still adhering to the manual start, so desirable under certain conditions.

The specifications for such apparatus should include the following features:

(a) That it shall be easily manipulated at time of start.

(b) That it shall be positive.

(c) That it shall not be of prohibitive expense.

In the class of heating plants which attract semi-automatic oil burners, the saving of the time of a janitor or fireman is usually of great importance. Any elimination of that part of the attendant's routine which is chargeable to oil burner maintenance represents a definite dollars and cents saving, as the attendant can be made useful elsewhere. It is desirable from a standpoint of economy to keep him out of the fire room, yet such economy must not be at the expense of safety.

It is happily possible, however, to achieve both ends by adaptation of comprehensive semi-automatic controls, which eliminate the hazards of personal inattention and carelessness and make the fireman even more available for other duties.

A simple combination of semi-automatic controls is shown in Fig. 1. A low-pressure heating boiler, with flame

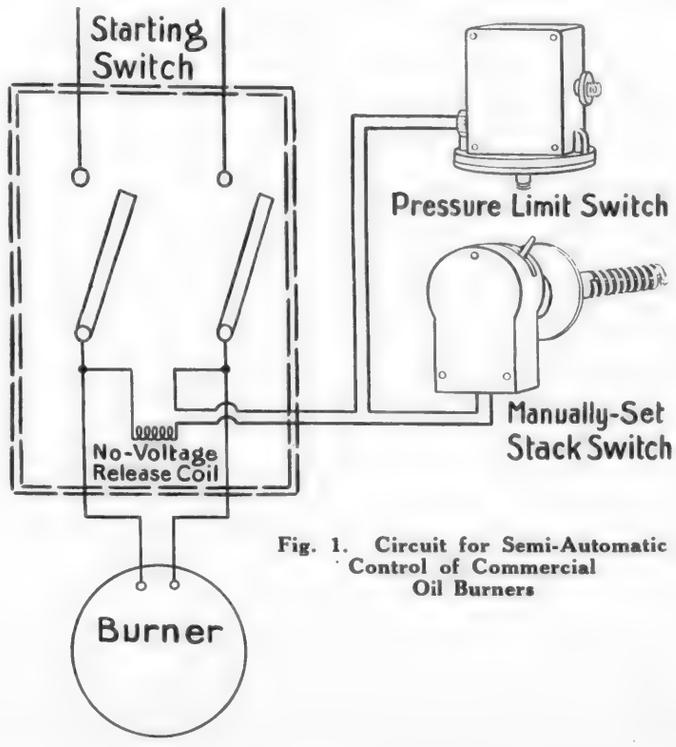


Fig. 1. Circuit for Semi-Automatic Control of Commercial Oil Burners

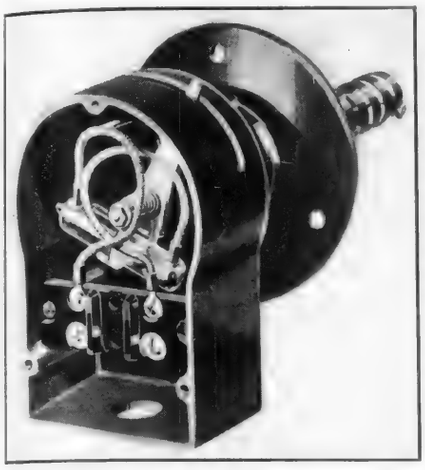


Fig. 2. **Stack Safety Device for Commercial Oil Burner Control**

controlled by steam pressure through the medium of a Sylphon arm and chain actuating the burner regulating devices, Fig. 2, is started and stopped manually by means of a starting switch equipped with no-voltage release coil.

In circuit with the no-voltage release coil is inserted a limiting-pressure switch, so that should the steam pressure arise improperly to undesirable limits, the no-voltage release mechanism will stop the burner, nor can it again be brought into operation until the attendant has come and started it manually.

A decline of steam pressure closes the pressure switch so that at the time of restarting the no-voltage release circuit will be found closed and ready for operation.

Another device in circuit with the no-voltage release is the stackswitch. Should the stack temperature fall below the figure indicative of the low fire setting (indicating that the fire is completely out) the stackswitch will open the no-voltage release circuit and shut down the burner.

With fires varying, due to their response to variations of steam pressure, the stackswitch should be widely adjustable to allow a considerable reduction of stack temperature due to normal causes, without consequent shut-down. A maximum tolerance of 200° between high stack-temperature with high fire and low stack-temperature with low fire has been found by experience to be ample to permit as wide a difference of fires as it is desirable to maintain. In many cases the instrument tolerance, (or as it is called "change factor") can be considerably less than 200°. It is entirely possible to employ a stackswitch with an adjustable change factor. Such a device is shown in Fig. 3.

This instrument carries a friction-clutch attachment between the heat-responsive element and the mercury switch, thus assuring that it will respond to increments of temperature, and that it will be unbiased by permanent set due to extreme stack temperatures.

Unlike the pressure switch, the stackswitch tends to open-circuit the no-voltage release each time the burner is stopped normally or abnormally.

To start the burner, the handle which projects through the slot in the case of the stackswitch must be manually depressed to the right. Thereafter, the burner may be started and the operator meanwhile may be free to make such adjustments at the burner as he may deem necessary. In any event the operator cannot carelessly fail to impose the safety provisions. That process is done automatically by the slipping action of the stackswitch.

While the addition of the limiting pressure-switch may be questioned by some engineers, the almost unanimous opinion of to-day favors the addition of the stackswitch. The pressure-switch is rapidly becoming popular in this connection as its application is better understood, and there is decided probability that its use will ultimately cover the field of high pressure boilers as well, as high pressure switches are now available in pressures ranging up to 300 lbs. per sq. in.

New, Enlarged Edition of House Heating with Oil Fuel

So widespread was the demand for authentic and unbiased information regarding domestic oil burners that the second edition of "House Heating With Oil Fuel," after having been reprinted, was completely sold out in a little more than twelve months. Since that time a new and greatly enlarged edition has been in process of preparation.

This third edition is now available in a cloth-bound volume of 366 pages with a colored frontispiece. The subject matter is grouped under 32 chapters covering almost every conceivable activity in this field of endeavor. More than 150 illustrations amplify the text; a large number of these were taken especially for this volume. Eleven unretouched photographs of oilburner flames especially demand attention as they represent the first attempt visually to portray oil combustion as produced by different burners.

Following two general chapters on the use of liquid fuel for house heating, there are two chapters on oil fuel, one on the theory of combustion and one on the practical considerations of combustion. Boilers and furnaces for use with oil burners occupy three chapters, and nearly 60 pages alone are devoted to the subject of oil burners in their different types, forms and details. Control for oil burners has received the attention due to its importance and the subject matter includes descriptions of equipment that were not announced to the public at the time of going to press.

The value of the Iso-Degree-Day Chart and the Iso-Oil-Consumption Chart, as evidenced since their development, leads to a special chapter on the subject of predetermination of oil-fuel requirements and, through the courtesy of the Heating and Piping Contractors National Association, the method of determining correct radiation for any enclosure, evolved by its Committee on Standardization, is presented. There is a chapter on selling oil burners and one on buying oil burners, considering this matter from the two diametrically-opposed viewpoints. The chapter "Installing the Oil Burners" is probably the most comprehensive and authoritative word on this subject that has been written.

The relations of the Underwriters to the oil-burner industry are covered in several chapters. The "Underwriters' Regulations;" "What the Underwriters' Listing Means" and "Domestic Oil Burners Listed by the Underwriters' Laboratories." This last chapter contains a chronological presentation of all oil burners that have been listed by the Underwriters and includes an alphabetical list of burners under label service, both of these being correct to May 1, 1927.

This book is a serious attempt to present a clear, unbiased and comprehensive survey of this young but rapidly-growing industry. Size 7 in. x 10 in. Pp. 366. Price $4.00 postpaid. Published by the Heating and Ventilating Magazine Co., 1123 Broadway, New York.

New Book

INVENTIONS AND PATENTS, THEIR DEVELOPMENT AND PROMOTION, by Milton Wright, associate editor of the *Scientific American*, contains some sound advice for inventors on how to make patents pay. The reader is told how to secure a patent, how to market a patent, with suggestions as to methods to be followed in raising capital. Other topics discussed are the relations of the inventor and his employer, the valuation of patents, advertising and publicity, trade marks and infringement. Size 5½ in. x 7¼ in. Pp. 225. Price $2.50. Published by McGraw-Hill Book Co., 370 Seventh Ave., New York.

The purchasing value of the dollar, as measured by living costs for the American wage earner and other persons of moderate means, which includes the great majority of the population, to-day stands higher than it has for more than two years past, according to the National Industrial Conference Board, 247 Park Ave., New York. The dollar is now worth, on the basis of present living costs, 61.1 cents as compared with the pre-war (1914) dollar. It was lowest in July, 1920, when it stood at 48.9 cents.

The purchasing power of the dollar has been thus enhanced by the steady decline in average living costs throughout 1925 and 1926, which last April, however, were still 63.7% higher than they had been in 1914, just before the war.

Present Practice in Vapor Heating

Previous articles in this series are:

1. *Webster Type R Modulation System, August*, 1926.
2. *Dunham Home Heating System, August*, 1926.
3. *The Illinois System, September*, 1926.
4. *Hoffman Controlled Heat, September*, 1926.
5. *The Mouat System, October*, 1926.
6. *The Trane System, November*, 1926.
7. *The Sarco System, December*, 1926.
8. *The O-E Perfect 3-in-1 System, January*, 1927.
9. *The Gorton System, February*, 1927.
10. *The Barclay System, May*, 1927.
11. *The Richardson System, June*, 1927.

12. The Barnes & Jones System

ALL efficient and successful modulation systems of vapor heating should embody the following factors: First, a positive circulation through every part of the apparatus at a lower pressure and more quickly than it is possible with the ordinary steam system; second, the whole or partial heating, as desired, of each radiator; third, economical operation; fourth, freedom from water hammer, or pounding, throughout either the radiators or piping; fifth, elimination of all air valves on the radiators; sixth, manipulation of only one valve—the control, or supply, valve—in connection with each radiator; seventh, the location of this valve in the most convenient position for operation; eighth, and lastly, fool-proof operation. These are the requirements drawn up by Barnes & Jones, of 5 Melrose St., Boston, Mass., manufacturers of the Barnes and Jones modulation vapor system.

GENERAL PIPING ARRANGEMENT

The Barnes & Jones system has been designed to incorporate the features mentioned. As illustrated in Fig. 1, this system for residence installation consists of a boiler set at a central point, with a split steam main running around each side of the residence to the rear, where both mains terminate just before they meet. These mains are pitched downward with the steam flow and are connected by a drip on the end of each main to a wet return run below the boiler water-line. This drip is carried back to the boiler, running along the floor, and has no other connections made to it outside of the steam main drips.

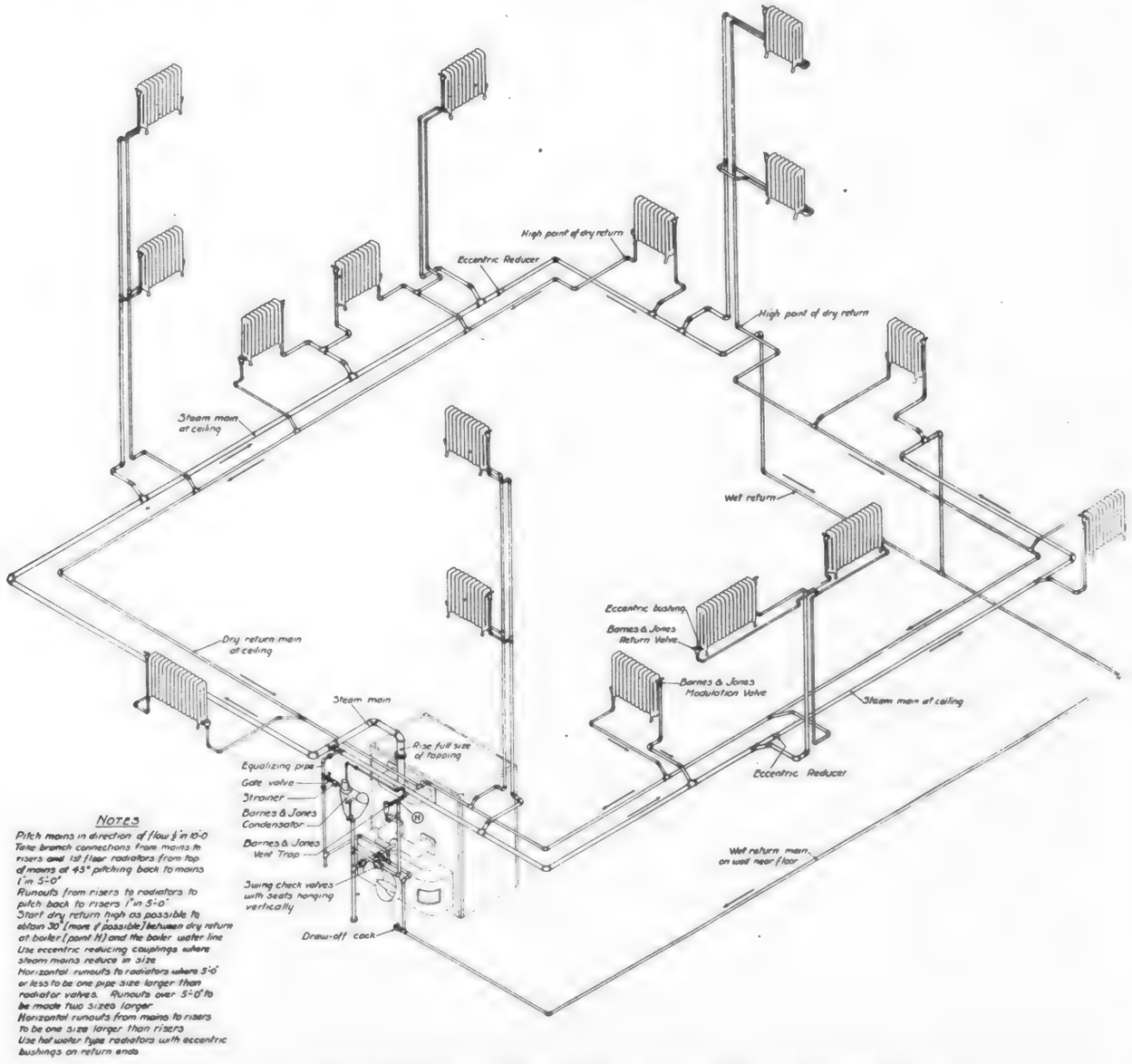

High point of dry return
Eccentric Reducer
High point of dry return
Steam main at ceiling
Wet return
Eccentric bushing
Barnes & Jones Return Valve
Dry return main at ceiling
Barnes & Jones Modulation Valve
Steam main
Steam main at ceiling
Rise full size of tapping
Equalizing pipe
Gate valve
Strainer
Barnes & Jones Condensator
Barnes & Jones Vent Trap
Eccentric Reducer
Swing check valves with seats hanging vertically
Wet return main on wall near floor
Drain-off cock
NOTES
Pitch mains in direction of flow ½ in 10-0
Take branch connections from mains to risers and 1st floor radiators from top of mains at 45° pitching back to mains 1 in 5'-0"
Runouts from risers to radiators to pitch back to risers 1 in 5'-0"
Start dry return high as possible to obtain 30" [more if possible] between dry return at boiler [point H] and the boiler water line
Use eccentric reducing couplings where steam mains reduce in size
Horizontal runouts to radiators where 5'-0" or less to be one pipe size larger than radiator valves. Runouts over 5'-0" to be made two sizes larger
Horizontal runouts from mains to risers to be one size larger than risers
Use hot water type radiators with eccentric bushings on return ends

Fig. 1. Typical Residence Layout, Barnes & Jones Vapor Heating System

The steam risers and branches to the first-floor radiators are taken from these steam mains by means of tees turned up on a 45° angle, with a 45° ell on top to make the horizontal run. The risers and first-floor runouts are arranged to drain back into the main. On the inlet of each radiator a modulation valve is placed to control the flow of steam into the radiator. The placing of this valve at the top inlet of each radiator is said to cover the sixth and seventh points enumerated at the beginning of this article.

At the bottom tapping of the radiator, and on the opposite end, is placed a Barnes & Jones return valve, and the returns are carried back from these traps in a separate dry return line to the boiler. The two dry return mains, one from each side of the building, are connected together and vented through a Barnes & Jones vent trap. This is designed to cover the fifth point previously mentioned, as by this method of air venting, no air valves are required on the radiators. The drip line is carried back from the extreme ends of the supply mains to the boiler as a wet return, and pitching down toward the boiler all the way.

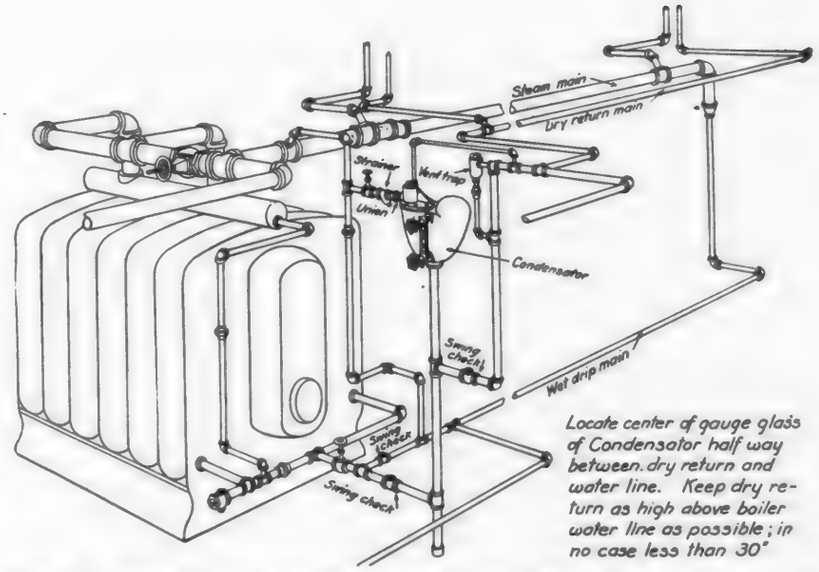

Steam main
Dry return main
Strainer
Vent trap
Union
Condensator
Swing check
Wet drip main
Swing check
Swing check
Locate center of gauge glass of Condensator half way between dry return and water line. Keep dry return as high above boiler water line as possible; in no case less than 30"

Fig. 4. Typical Installation of Barnes & Jones Vapor Heating Specialties

Fig. 2. Barnes & Jones Modulation Valve

After the air is vented from the dry return, the dry return drops below the water line and becomes wet. The water of condensation passes on through a check valve, before it reaches the connection to the condensator, and thence through another check valve to the boiler.

A steam line is run to the condensator from the main steam header, with stop valve and strainer. An air line is carried from the condensator to the dry return and the condensator is vented through this line and thence to the atmosphere, through the Barnes & Jones vent trap.

As far as the piping is concerned this is all there is to the system, the arrangement being simple and clean-cut.

MODULATION VALVE EMPLOYED

In Fig. 2 is shown a view of the modulation valve used on the radiator inlets, this valve being packless and having a non-rising stem and with renewable disc seat. It can fully be opened or closed in less than one complete revolution of the handle. These valves are made in all standard pipe sizes from ¾ in. to 1½ in. and are of composition steam metal, heavily nickel plated. Complete control of the amount of steam entering the radiator is provided by the valve which, when fully open, has a free area practically equal to the connecting pipe.

For radiators up to 60 sq. ft., ¾ in. valves are recommended, while from 60 to 100 sq. ft., 1 in. valves are used; for radiators above 100 sq. ft., and not exceeding 180 sq. ft., the 1¼ in. is the least size that should be employed, and over 180 sq. ft., the 1½ in. valve is recommended.

TRAPS ON RETURN ENDS OF RADIATORS

For the traps on the return ends of the radiators, ½ in. traps are installed on radiators up to 100 sq. ft., ¾ in. traps up to 240 sq. ft., 1 in. traps up to 600 sq. ft., and 1¼ in. size up to 1200 sq. ft. These traps are of the thermostatic-diaphragm type, the motive power being supplied by a volatile fluid enclosed in a hermetically-sealed diaphragm, or chamber; the bodies are constructed of steam metal and the outlets of all standard ½ in. traps are made ¾ in. to get away from the use of ½ in. pipe, even when the ½ in. trap capacity is sufficient.

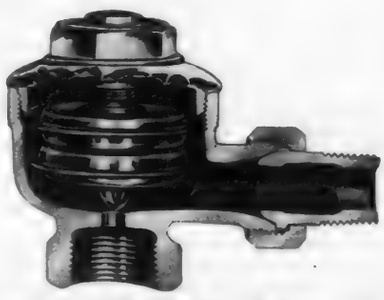


Fig. 3. Construction of Barnes & Jones Radiator Return Trap

AUTOMATIC RETURN UNDER PRESSURE CONDITIONS

To return the water to the boiler, even under pressure conditions, the condensator is used. This condensator is not as complicated as its name would imply. It consists of an enclosing vessel in which a float valve is located. Whenever the boiler pressure is sufficient to back the return up into this chamber, which is set as high above the boiler waterline as possible, the float rises and opens the steam-pipe connection from the boiler main which allows the boiler pressure to enter the top of the condensator and counterbalance the boiler pressure holding back the return, so that the return water in the chamber will sink down by gravity and enter the boiler.

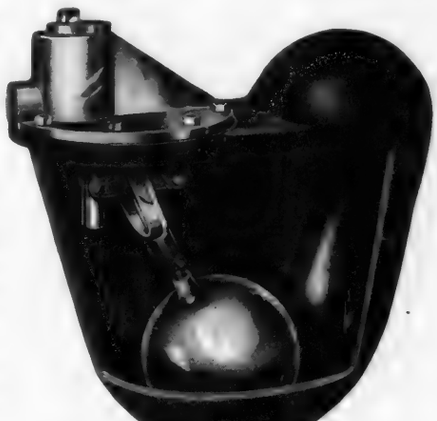


Fig. 5. Condensator for Returning Water to Boiler Against Pressure

AIR ELIMINATION VALVE

To eliminate the air from the system the vent trap previously mentioned is used. This trap, shown in Fig. 6, consists of a chamber in which a float is located so that the air will have free

outward passage, but the entrance of water will at once cause the float to rise and close the outlet. The re-entrance of air is prevented by the small ball-check contained in the channel through which the air is expelled.

TRAPS FOR FAN-BLAST HEATERS

For use on fan-blast heating coils a special blast trap has been developed

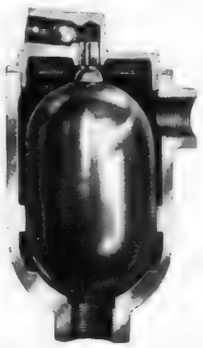


Fig. 6. Vent Trap Used with Barnes & Jones System

by this organization; illustrated in the sectional view shown in Fig. 7. The air and water are both handled by this trap, which employs a float-operated valve to care for the water, and has also a thermostatic valve incorporated

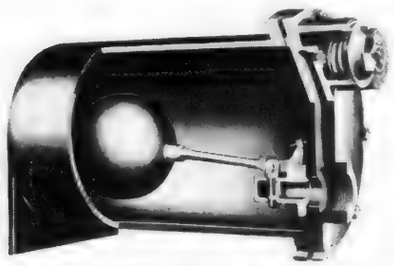


Fig. 7. Blast Trap for Use on Fan-Blast Coils

in the top to handle the air which may have to pass through the trap from time to time. These blast traps are made in sizes from 1 in. to 2½ in. and have capacities ranging from 1000 to 5000 lbs. of water per hour.

New Publications

DON'T COME BACK is the latest circular issued by the American Blower Co., Detroit, Mich., in its series on "Bad Air Is Bad Business." In this circular the spirit of Bad Air is whispering to the restaurant guest, "Don't Come Back." The circular urges the use of American electric ventilators to clear the air of smoke, odors and fumes. A table is included giving the frequency of air changes necessary for various quarters.

A DISTRIBUTION CENSUS OF BALTIMORE, MD., published by the Domestic Distribution Department of the Chamber of Commerce of the United States, is described as the first census to be made of retail and wholesale trade. The facts were gathered by the Census Bureau and covered all the business establishments in Baltimore engaged in distributing merchandise. Copies of the booklet are available at 25 cents from the headquarters of the chamber, in Washington, D. C.

Richmond Radiator to Market Gas-Fired Boiler

The Richmond Radiator Co., New York, announces that it has acquired the Heatomat gas-fired boiler line, developed by the United Utilities & Engineering Corp., Philadelphia, and will manufacture and sell these units in conjunction with the present line of coal boilers, radiators and allied equipment.

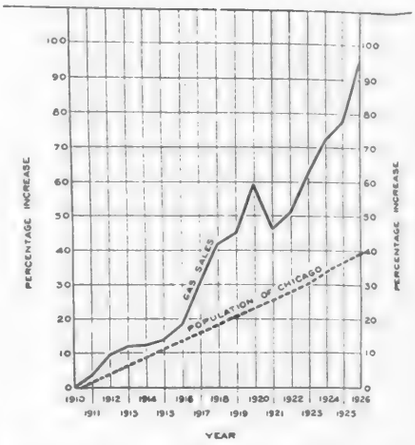
The Heatomat boiler is designed for water, steam or vapor heating. It is of the cast-iron, vertical tubular sectional type, units normally being composed of from 5 to 8 sections. Cast-iron nipples are used to join the sections.

The hot water type is equipped with a preheater through which the return water and the gases from the boiler bonnet are circulated.

Only one burner is used for any given battery of sections, primary air being fixed and secondary air being controlled by a shutter operating through the thermostatic control.

A. A. Marks, designer of the boiler, and former president of the United Utilities & Engineering Corporation, has been retained by the Richmond Radiator Company and will be in charge of the gas boiler division, with headquarters at 2220 Chestnut Street, Philadelphia.

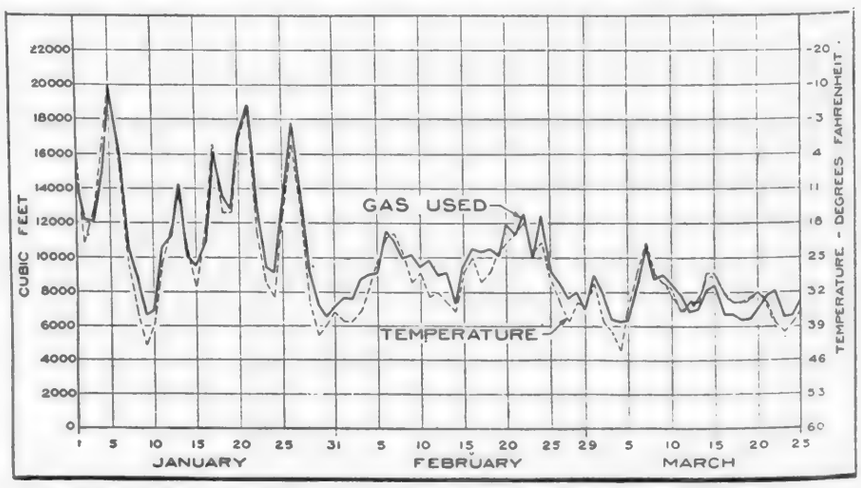
1927 YEAR BOOK of the Peoples Gas Light & Coke Company (Chicago) contains some striking data on the growth, even during the past year, of the gas industry in the Chicago district. Industrial Chicago, it is stated, burned 736,888,000 cu. ft. more of gas in 1926 than in 1925, an increase of 19.7%. Peoples gas mains are now connected at eight



Increase in Gas Sales in Chicago Compared with Increase in City's Population

points with the mains that supply gas to surrounding suburbs in Illinois and Indiana. This enables the interconnected companies to take gas from wherever it can be produced most economically. The "back-bone," or, more accurately, the main artery of the interconnected system is the company's 4-ft. gas main across the western flank of Chicago. An 11-mile extension is now being constructed. The completed main will be 34 miles long, from North Shore Avenue and Whipple Street to the 96th Street plant at Baltimore Avenue and 96th Street.

In its comments on the use of gas for house heating, an impressive chart is presented comparing the increase in gas sales with the increase in population. Another chart shows how closely the gas consumption in automatically-regulated gas-fired house-heating furnaces, with thermostatic control, corresponded with the outdoor temperature curve for the same period. According to the report, there are now over 5000 domestic customers in Chicago, including those using gas-fired garage heaters, gasteam radiators and auxiliary space-heating appliances. Over 1500 Chicago homes have gas-fired central heating plants, and this number, it is added, will be increased by 1000 or more this year.



Relation Between Temperature and Gas Used in Three Chicago House-Heating Installations

Delegates Assembled for Third Annual Convention of the Williams Oil-O-Matic Heating Corporation

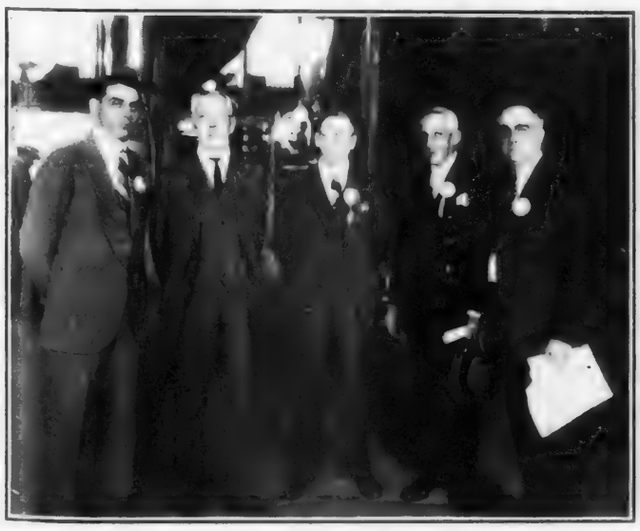
Oil-O-Matic Third Convention a Great Success

MEMBERS of the Williams Oil-O-Matic Heating Corporation and its sales force gathered from all parts of the United States and Canada, as well as from many foreign countries, to join in the third annual convention, held in Bloomington, Ill., June 6-7.

It is reported that over 1500 delegates registered and participated in the two-day program and festivities. The most recent addition to the factory, known as No. 2, was cleared and used as a convention hall and for the several meals that were served to the assemblage. One of the features was a sunrise breakfast, at six o'clock, at which all of the sales representatives reported present.

Two important features of the convention were the presentation to the delegates of the new Williams electric refrigerator and a new model Oil-O-Matic having less capacity than the Model G. The refrigerating units are built in several sizes, having capacities from 5 to 20 cu. ft. The burner was shown operating in the open to demonstrate the high degree of combustion efficiency attained. It will sell for a much lower price than the Model G, and is designed for the owner of a small home, who desires to get rid of the coal-shoveling "bogie." This unit is designed to burn 28° A.P.I. oil, and it will operate properly when consuming as little as ½ gal. per hour.

Following the assembly on Monday morning, June 6, at which the delegates were welcomed by R. D. Marshall, of the home office, and R. O. Ahlenius, president of the Bloomington Association of Commerce, the convention proceeded with the following speakers: C. U. Williams, president, and Walter W. Williams and Lawrence L. Smith, vice-presidents of Williams Oil-O-Matic Heating Corporation; Leod D. Becker, managing director of the American Oil Burner Association; Leroy A. Kling, president, and C. E. Widney, secretary, Kling-Gibson Co., Chicago; Homer Linn, American Radiator Co., Chicago; O'Neill Ryan, Jr., assistant general sales manager, Celotex Co., Chicago; David Rosenblum, president, Business Training Corp., New York, and Louis L. Emmerson, secretary of state for Illinois.



Company Officials and Guests at Williams Oil-O-Matic Convention

(Left to right) Walter Williams, vice-president; Ned Dolan, president Pantagraph Printing & Stationery Co.; Homer Linn, American Radiator Co.; Louis L. Emmerson, secretary of state for Illinois; and President C. U. Williams

Foreign Delegates in Attendance at Williams Oil-O-Matic Convention

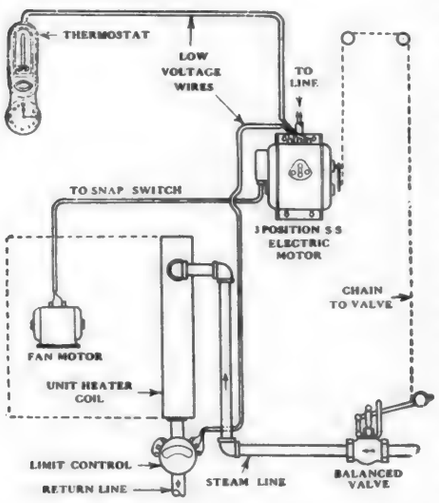
Included in the group are M. Folch, chief engineer for the company's Spanish distributor; Maurice Hebbelynck, distributor for Belgium; and Joseph Dapfer and F. E. Brandeis, representing Oldenbuttel & Brandeis, distributors for Germany

New Apparatus and Appliances

Minneapolis Unit Heater Controls

The rapidly increasing use of unit heaters in factories and industrial buildings has induced the Minneapolis Heat Regulator Co., Minneapolis, Minn., to develop several systems of unit-heater control, each based upon desired conditions of operation. Automatic control is obtained with a Minneapolis three-position S-S electric motor, with three-position secondary circuit selector and built-in fan-motor switch, a balanced lever quick-opening steam valve, a Minneapolis limit control and a thermostat.

The thermostat is located in a place where the average room temperature



Minneapolis Unit Heater Control

exists; the limit control is inserted in a tapped opening in the steam line just after it leaves the heating coil in the unit heater; the balanced lever valve is set in the steam line at a point convenient for making connections to the electric motor; the electric motor is mounted on either the wall or a pillar to insure rigid and permanent support.

Assuming steam is up, the operation of the Minneapolis control system is as follows: with the thermostat indicator 2° above the room temperature, this will make contact through the thermostat to the electric motor, causing an operation through ⅞ of ½ revolution, which opens the lever valve in the steam line. The limit control binding posts marked "from thermostat" are bridged, making the limit control an independent control and directly connected with the motor in such a manner as to operate the motor when the heating coil cools or when it is sufficiently heated.

As yet the fan has not been started. This method of operation insures the heating coil being thoroughly heated before the fan begins forcing air through it into the room. It eliminates blowing cold air out of the unit heater, which will occur if the fan is started at the same time the steam is turned on. When the heating coil is up to the temperature desired, the limit control operates and causes the electric motor to make a second operation, which closes the switch in the fan motor circuit and starts the fan. When a direct out-door air intake is used, louvers can be opened at this point by the electric motor.

The unit heater is now in full operation and will continue so until the room reaches the temperature at which the thermostat is set. When this temperature is reached, the thermostat again makes contact, causing the motor to make a full ½ revolution which shuts off both the fan motor and the steam valve. Also the pull on the louver operating arm is released and the shutters close by gravity. In case the steam pressure drops during the time the heater is in operation, the fan motor and valve will be shut off by the limit control.

The heater is thus prevented from discharging unheated air into the room; the room thermostat is still calling for heat, so the electric motor will immediately open the steam valve. This will allow steam to enter the coils as soon as there is sufficient pressure, at which time the limit control allows the fan to start. The heater then continues in operation until shut off by the thermostat.

A somewhat simplified control also has been brought out where the steam valve is eliminated and steam therefore is not shut off from the coils. In this design the fan will be shut down whenever the thermostat registers a temperature above that desired. The fan again will be started to supply heat unless there is no steam in the coils, when the limit-control will hold the motor circuit open until the coils are supplied with steam.

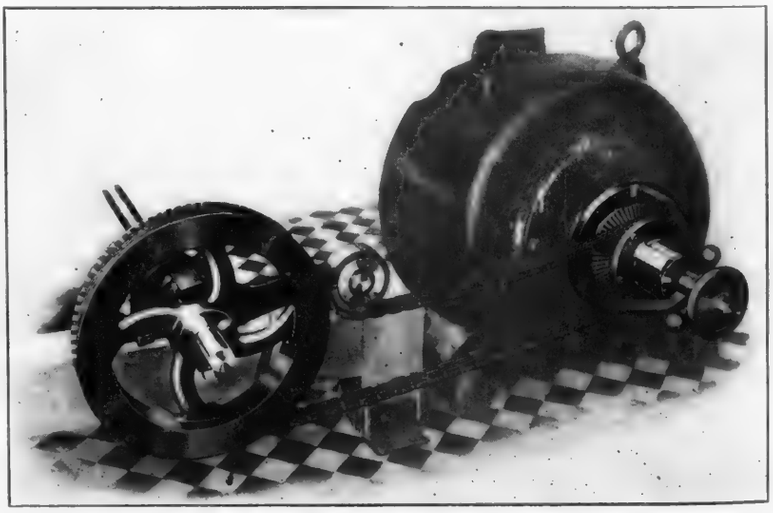
It is obvious that economies are the result of such controlled operation, and it is claimed that fire risks are lowered, as in case of fire the thermostat will shut off the fan, the blast from which would serve to spread the flames.

A Positive-Drive Infinitely-Variable Gear for Electric Motors

A new British invention known as the "P.I.V." (positive infinitely variable) gear, it is claimed, enables the constant-speed alternating-current electric motor to be used direct, with an open chain, at any centres, for variable-speed shaft driving, without the use of transformers and direct-current motors. As is well known, an alternating-current motor will only run efficiently at one constant speed. Consequently, by means of this new gear, the constant-speed A.C. motor can be used directly, giving, it is stated, as good a result as the D.C. motor, without the cost and trouble, to say nothing of the loss of power involved in transforming.

As an example of the conditions obtaining with the "P.I.V." gear, a case is cited of a typical long-centre open-chain electric drive which has an A.C. motor running at 1000 R.P.M., while the driven shaft can be varied infinitely between 250-500 R.P.M. merely by means of a wheel control. In this arrangement, characteristic "P.I.V." opposed conical-disc expanding pulleys, with alternate ribs and channels on the inner surface, are fixed on the motor shaft, with a special chain running between, while on the driven shaft is a fixed pulley having a groove, fitted to engage with the chain.

On manipulating the wheel control, the two conical disc driving wheels are altered in position longitudinally along the shafts so that the driving chain rises or sinks in the grooves between



"P.I.V." Gear Applied to Electric Motor

the ribs, which act as teeth, altering the effective diameter and, therefore, the speed of the driven shaft. This, of course, is quite different from any arrangement of ratchet drive, for example, or from slipping devices using two cone pulleys and a belt.

A Dust Arrester Screen Vibrator

To obviate the objection to conventional vibrators used with dust arresters of the screen type, the Northern Blower Co., Cleveland, O., has devised a type radically different from anything heretofore used. Dust arresters of this class require frequent rapping in order to detach the loose dust from their surfaces and thus make them more effective. Hitherto this has been accomplished by cam-actuated spring pistons or similar devices, extending the entire length of the screen gangs. In actual practice, it is claimed, such devices do not uniformly clear the screen surfaces.

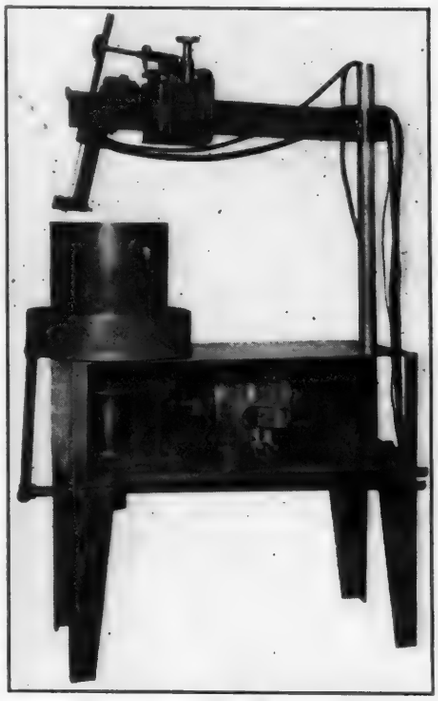
The new vibrator now being adopted on all the larger models of the Norblo cloth-screen type dust arresters consists of a single electrically-operated rapper which travels slowly on rails from end to end of the screen gang, vibrating each individual screen thoroughly as it passes under it. Since only one rapping piston is necessary this can be and is constructed in the most substantial manner. Ball bearings are provided throughout and all working parts are enclosed in a dust-proof cast-iron case. All bearings are packed with many months' supply of grease, and the mechanism is guaranteed to work without any attention or replacement of parts for at least one year from the date of its installation.

The operating motor is fed from a set of trolley wires by means of a double collector arm and drives the rapping piston through a bevel reduction gear. The gear-shaft carries a cam which operates the rapping piston against the action of a powerful spring, thus giving a very rapid succession of upward blows to the under side of the screen-gang frame. At the same time, the entire mechanism is driven slowly along the rails by means of a steel worm and gear. The whole equipment, including the rails, is protected from the weather by being enclosed in the airtight case in which the screens are placed.

To clean the screen, the attendant shuts off the exhaust fan and presses a push button which starts up the rapping and traveling mechanism of the screen-vibrator. When the vibrator reaches the limit of its travel, it automatically engages a reversing relay switch and commences to return to its starting point. On reaching its original position, it automatically shuts off the current and stops itself. The exhaust fan now may be re-started, although for the most effective cleansing of the screens it is advisable to allow a few moments for the dislodged dust to settle into the hoppers below the screens.

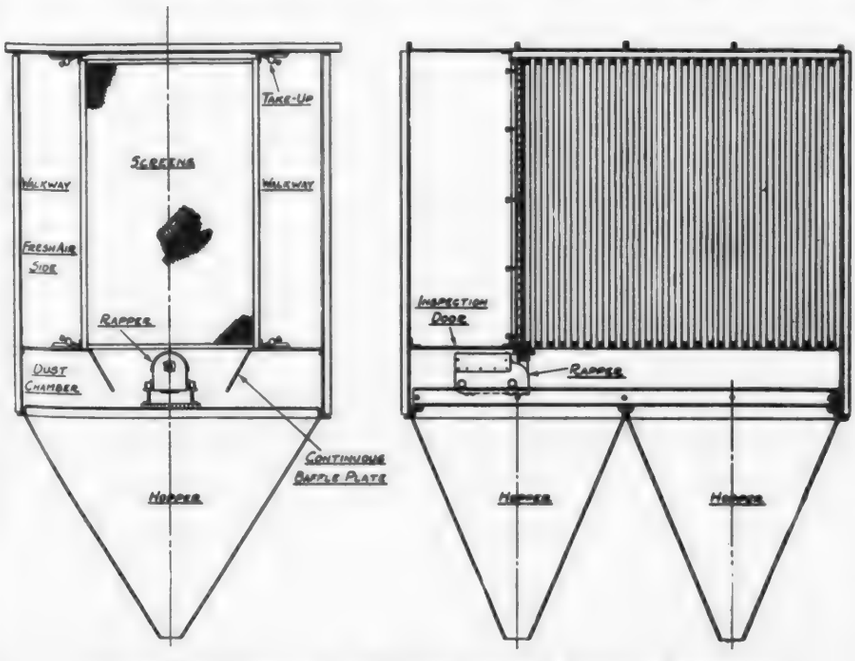
Arc Welding Under Water

The rapid developments that mark the progress of electric welding are well illustrated in a new machine, designed and built by the Lincoln Electric Co., Cleveland, O., for the automatic welding of circular seams up to 12 in. in diameter. An interesting metallurgical consideration is the arrangement for water cooling, whereby the piece on which the welding is being done may be partially or totally immersed in the water during the welding operation. This novel arrangement was developed



Lincoln Circular Welder

to meet the requirements incident upon welding high-grade alloy steels in which the heat disturbance due to application of welding heat, must be reduced to a minimum. In the case of 12% manganese steel, the welding may be done with the piece totally immersed in water and the arc submerged. This cooling arrangement is well adapted to the welding of manganese, since the rapid quenching of the molten metal gives it the physical properties expected in this alloy. As an example of the use of the machine, the frame itself is of welded steel construction and represents an excellent example of the growing tendency to replace iron castings with fabricated metal forms.



End and Side Views of Norblo Dust Arrester, Showing Rapper for Vibrating Screens

Kalkite—New Insulating Material Installed with a "Gun"

A new form of house insulation composed of vegetable fibre and gypsum, chemically treated, is announced by The Kalkite Co., Forest Park, Ill. While this material probably presents no new standards of heat resistance, the method of application is ingenious and should open up a wide field of application to existing homes.

Kalkite is applied in fluid form, with an equipment similar to the cement "gun," that forces the material into cracks and crevices more completely than would be possible without the pressure. It is the plan of this company to provide installation crews and so to systematize the method of application that the average home can be insulated from cellar to attic in a single day, and the larger homes in double that time. All of the work is done from the cellar and attic and the interior of the rooms is not defaced in any way.

The Bauer Boiler — A New Type

One of the most interesting of the new types of steel boiler for domestic use has been brought out by H. C. Bauer Co., Philadelphia. The intent of the design is to provide heat-transfer surfaces, both direct and secondary, of such character and area that the flue gases will be brought down well toward the minimum point with corresponding high efficiency.

A feature of the design is the exceptional height of the combustion chamber, attained through the placement of the secondary surfaces around the sides of the boiler, rather than at the top. Resting on the ash-pit unit is an annular lower water-leg enclosing the grate area, the grates being flush with the top of this ring. At the top of the boiler is a cylindrical header forming the steam dome. This is connected to the lower ring by twelve to sixteen 4-in. tubes rolled into the upper surface of the lower ring and the lower surface of the dome. Concentric within these tubes are 3-in. tubes rolled into the lower surface of the lower ring and the upper surface of the dome. Baffle elements are inserted between the 4-in. tubes, extending up well toward the top of the combustion chamber and forming, with a portion of the tube surfaces, the walls of the fire-pot.

Construction of Bauer Boiler, Showing Arrangement of Secondary Tubes Around Sides of Boiler

The products of combustion then rise in the combustion chamber, pass over the top of the baffles and down around the outer surfaces of the tubes to an annular space below the lower water-leg. They then rise through the 3-in. tubes to the space above the dome and thence to the bonnet. As water fills the ½-in. annular space between the tubes a rapid heat-transfer is possible through the thin steel walls on both sides of the water. Although the gas travel may appear tortuous, it is stated that the resistance from the top of the fire to bonnet is only 0.03 in. The vertical water-tube construction makes for rapid circulation and quick action when heat is applied.

A test recently made on one of these boilers, rated at 750 sq. ft., by Julian S. Simsohn, consulting engineer of Philadelphia, is quoted to indicate the performance that can be secured.

The heating surface in this unit was 63.8 sq. ft., and the fuel bed area was nearly 3 sq. ft. At the beginning of the test, in which a chestnut anthracite coal was used, a carefully-observed thickness of burning fuel maintained 2 lbs. steam pressure on the boiler. About 159 lbs. of coal was then fired at one time, the height of the charge reaching to the middle of the firing-door. The draft was then thrown on and with the exception of furnishing a load necessary to keep the steam pressure at 2 lbs., the operation of the boiler was not interfered with during the next six hours,—the duration of the test.

Water was fed to the boiler at a temperature of 48° F., and steam was delivered to the atmosphere. Some of the observations taken during the test, as well as the calculated results, are presented below. Correction is made in the evaporation figures for the moisture in the steam. At the termination of the test the fuel bed was reduced to the same condition that prevailed at the beginning of the test, and the refuse was removed from the ashpit for weighing and analysis. It was noteworthy that the furnace refuse actually weighed 26¼ lbs., whereas the weight as calculated from the analyzed ash content in the coal and the analyzed percentage of combustible in the furnace refuse was 26.88 lbs.

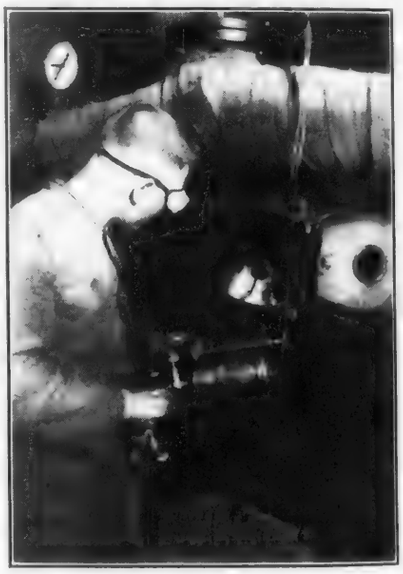
Following are some of the significant data and results of the test:

Duration of test	6 hours
Average steam pressure	2.2 lbs.
Average temperature feed water	48° F.
Average temperature chimney gases	365° F.
B.T.U. per lb. dry coal	12,695
Coal as fired per hour	26.38 lbs.
Dry coal, per hour	25.38 lbs.
Actual water per hour	230.0 lbs.
Factor of evaporation	1.172
Equivalent evaporation per hour	269 lbs.
Actual evaporation per lb. fuel as fired	8.72 lbs.
Equivalent evaporation per lb. fuel as fired	10.20 lbs.
Equivalent evaporation per lb. dry fuel	10.6 lbs.
Efficiency of boiler, overall	81.03%
Average capacity	1076 sq. ft.

An examination of these figures will show that, although the boiler was driven throughout the test at a relatively high rating, the unit equivalent evaporation was very good. Tests conducted at somewhat lower loads indicate that with the low radiation-loss due to the insulation features of the boiler, with a somewhat higher grate efficiency, the overall efficiency likewise can be improved.

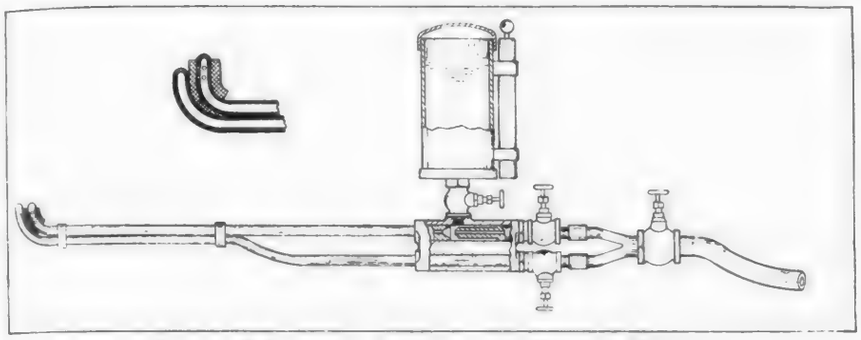
Ruetsche System for Cleaning Boilers

An ingenious system for cleaning steam and water boilers, which has been placed on the American market by Horldt & Bihler, Providence, R. I., provides for producing on the boiler-wall an expansion in spots by means



Cleaning a Boiler by the Ruetsche Process

of an oil-oxygen flame. According to the inventor, the application of such a flame causes a movement between the boiler-wall and the encrustations. The iron of the boiler-wall expands more rapidly than the encrustations, so that, in consequence, there is a tension arising in the latter causing them to burst away from the boiler-wall. One of the advantages of this method is that boilers no longer need to be dismantled in order to clean them. It is also possible to clean low-pressure boilers during the heating period without having



Design of Ruetsche Appliance for Cleaning Boilers

the function of the boiler disturbed by the process.

The apparatus consists of an oxygen-flask of about 2200 lbs. pressure per square inch directly connected to the conduction tubes and nozzle. Above the conduction tubes is a container for fuel-oil. In order to make possible the turning and revolving of the apparatus in every conceivable position, the fuel-oil is put under pressure by means of an air pump attached to the container. The weight of the appliance is given as 8 lbs. with container filled. It is recommended, however, that the container be not completely filled so that the oil may be forced toward the outlet of the container in all positions. There must remain a free space for the compressed air to be generated by the air-pump.

Operating Data with the Johns-Manville Radiator Control Valve

In the accompanying charts are given the radiator surface temperatures which were secured in a test with a No. 2 Johns-Manville radiator control valve attached to a 40-sq. ft. water-type, 15-col., 26-in. water-type radiator, supplied with steam at 1-lb. pressure.

A Johns-Manville radiator trap was connected on the return side and the return was operated under atmospheric pressure.

The dotted lines in Fig. 2 show the average temperatures of the tops and bottoms of the columns of the radiator at different valve settings. The full line shows the average temperatures of the entire radiator. The temperatures of the columns farthest from the valve were found to be the same, within a very few degrees, of the temperatures on the columns nearer the valve.

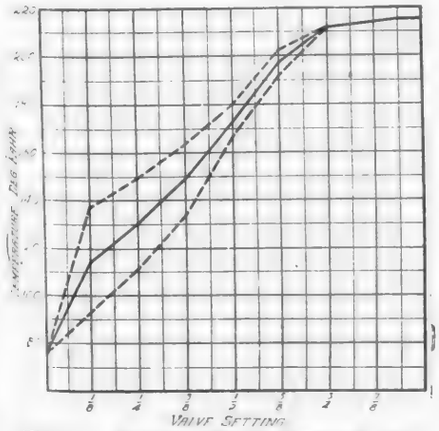


Fig. 1. Heating Effect obtained with Johns-Manville Radiator Control Valve

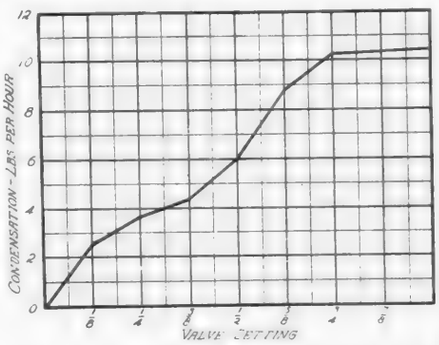


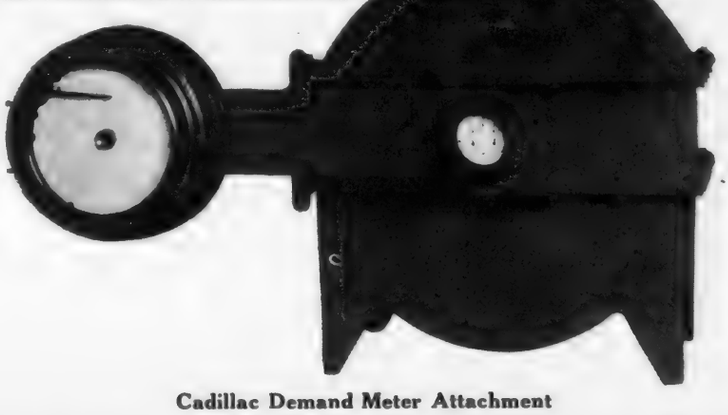
Fig. 2. Quantity of Steam Admitted to Radiator, Under Conditions of Test, at Various Opening Positions of Valve

As announced in the May issue, this valve has been placed on the market by the Johns-Manville Corp., New York.

Steam Demand and Condensation Meters

Attaching, with a special bracket, gear train and link connection, a General Electric demand meter to a Cadillac condensation meter (in the three larger sizes), a novel combination has been provided whereby a seven-day chart record may be had showing condensation for intervals of 15, 30 or 60 minutes, while the continuous record of aggregate condensate is made in the usual way. This combination is manufactured by the Central Station Steam Co., Detroit, Mich.

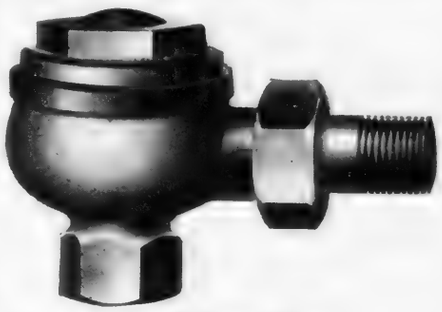
The rotation of the Cadillac meter drum is transmitted to the recording mechanism of the demand meter through the train of gears and linkage, the record being made with stylus on either waxed or smoked paper. The chart is driven by clockwork which also re-sets the stylus at desired intervals. This provides three forms of demand meters for almost any conditions. Any of these three re-set periods can be supplied to fit the size E, F or G meters. In supplying the attachment the counter housing, counter and counter-mounting studs are removed and replaced by a special bracket containing the gear train. The original condensation meter counter and housing are then re-installed on the new parts and function as before. The demand meter can be placed on either side of the face of the condensation meter.



Cadillac Demand Meter Attachment

New Design of Marsh Reflux Trap

A return trap of improved design, for use on the return end of a radiator or coil of a vacuum, vapor or atmospheric heating system, is announced by Jas. P. Marsh & Co., Chicago, Ill., under the name of the Marsh ½ in. No. 1 improved Reflux trap. It is of all-metal construction, the only moving part being the non-collapsible thermostatic diaphragm, made of phosphor bronze and corrugated to prevent rupture from alternate expansion and contraction. Its non-collapsible feature, which is characteristic of all Marsh Reflux traps, is due to the inner reinforcement of the diaphragm.

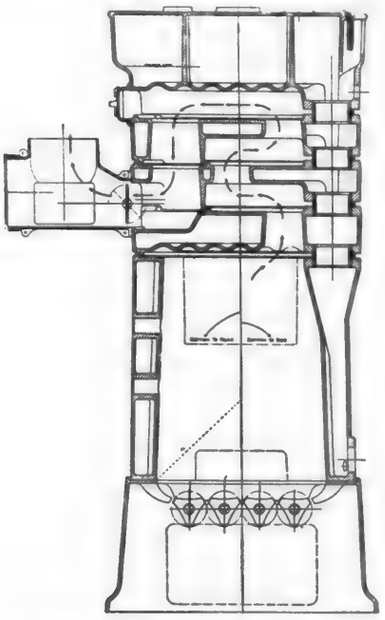


Marsh Reflux Trap

New Trade Publications

THE TEST LOG is a little folder telling of the progress of the Frost Laboratory at Norristown, Pa. In the latest issue is the story of some boiler tests made for a prominent manufacturer. These showed that the efficiency "developed" in previous tests could not be equalled in this laboratory where the A.S.H. & V.E. code is strictly followed. It was reported that the manufacturer, while surprised, was convinced that the results were accurate and published the conservative ratings rather than the exaggerated ones.

RARITAN BOILERS AND RADIATORS for steam and water heating are presented in a new catalog (Catalog No. 3, 1926-1927) issued by the Raritan Radiator Co., Raritan, N. J. These boilers are notable in that the sections, including the crown sheet, located between the firepot and the dome, provide the draft system and a large part of the heating surface. At the same time they are designed to furnish the largest possible



Section of Raritan IT Round Boiler

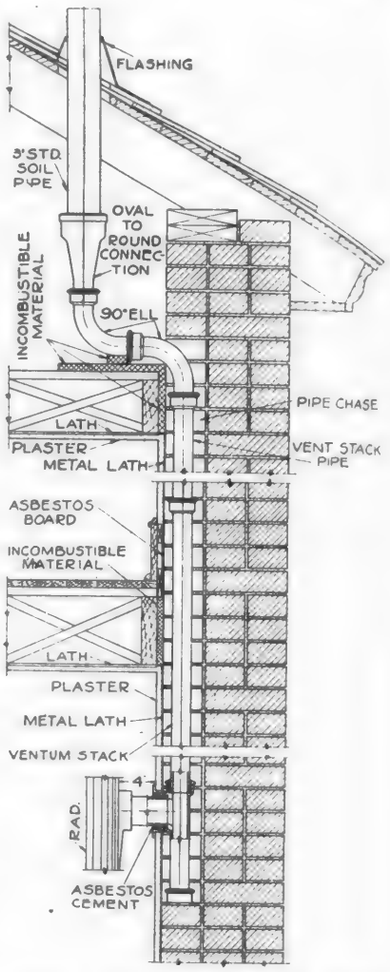
area of direct heating surface, with free and rapid circulation. The draft scheme staggers the flow of gases. The products of combustion pass up between the sections, traveling horizontally in their progress, striking the bottom of the dome and passing down the inverted flue. They make their exit from the boiler at a point well below the top. Size 4¾ in. x 7½ in. Pp. 16.

INTERNATIONAL FURNACE DATA BOOK, described as "the first authentic furnace data book for the trade," has been issued by the International Heater Co., Utica, N. Y. In addition to full data on the International self-cleaning Carton furnace, the Economy Blue Front furnace and the International heavy-duty heater, together with furnace pipe and fittings, the manual contains a wealth of handy information occupying some 70 odd pages. The standard code for furnace installation is given in full and the data conclude with a "heating dictionary." Size 3¾ in. x 6½ in. Pp. 222.

QUIXETT (QUICK-SET) RADIATOR, featuring the Merrill method of making radiator connections, avoiding the necessity of runouts, is illustrated and described in a newly-issued circular received from the Merrill Co., 98 Granite St., Boston, Mass. An interesting feature of the circular are views of buildings in which Quixett radiators have been installed. In the case of the Charles Chauncey Building, Boston, a facsimile letter from the building contractors, the George W. Harvey Company, is presented, expressing the builders' satisfaction and adding that Quixett radiators have been chosen for the 14-story building the company is erecting at West Palm Beach, Florida.

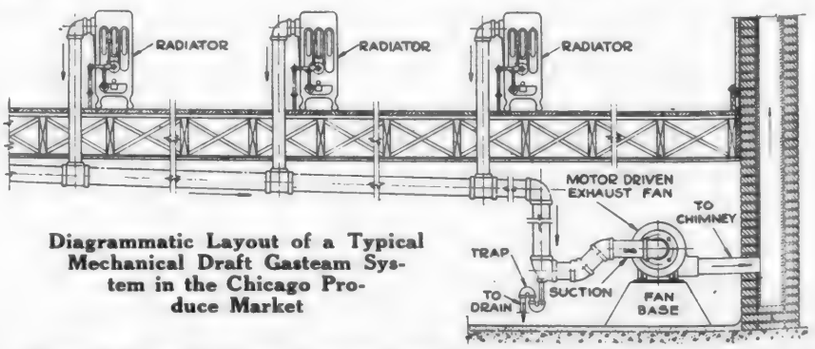
ADD ANOTHER ROOM TO YOUR HOME is the suggestion given in a circular devoted to the Quiet May automatic oil burner, manufactured by the May Oil Burner Corp., Baltimore, Md. By means of a cleverly-arranged flap a house is shown with a coal-burning boiler in the basement. When the flap is lifted we see the basement transformed, an oil burner installed and a billiard table taking the place of the coal bin.

175,000 SQUARE FEET OF BOILER CAPACITY, furnished by seven Pacific steel heating boilers in the Baltimore warehouse of Montgomery Ward & Company, is the caption of a circular issued by the Pacific Steel Boilers Corp., Waukegan, Ill. An impressive photograph is reproduced of the installation itself, accompanied by a view of the building and another view showing the oil-burning equipment. Six of the seven boilers are fired from the rear with straight-shot oil burners. The seventh is used for burning waste paper, crates and other refuse.



Ventum Cast-Iron Stack for Gasteam Vented Heating System, Showing Connection to Radiator, Drip Tee and Method of Running to Attic and Through Roof

CLOW GASTEAM VENTED HEATING SYSTEM is the subject of what is practically an installation manual, published by the manufacturers, James B. Clow & Sons, Chicago. After discussing the construction and operation of Gasteam radiators, the manual takes up, in order, gas piping sizes and specifications, construction and installation of Clow Ventum cast-iron oval vent stacks, specifications for Ventum stacks and for tile vent stacks, the manual concluding with comprehensive data on mechanical vent systems for Gasteam radiators, which also go under the name of fan draft systems



Diagrammatic Layout of a Typical Mechanical Draft Gasteam System in the Chicago Produce Market

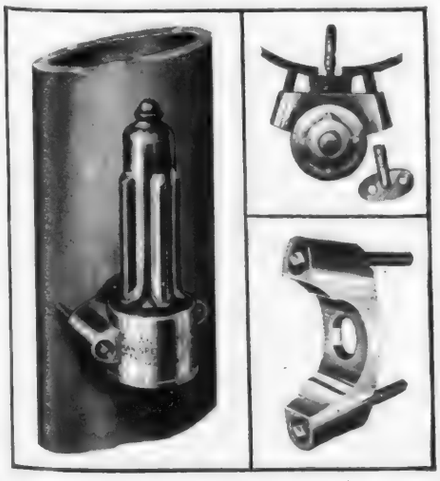
Gasteam radiators are placed against various convenient walls and a vent pipe is run down through the floor where it connects into a main vent line or manifold

for Gasteam heating. The diagrams include installation details of each method of venting. In the case of the mechanical draft system, a complete layout is given. Size, 8½ x 11 in. Pp. 24. (A.I.A. File No. 29-f-4).

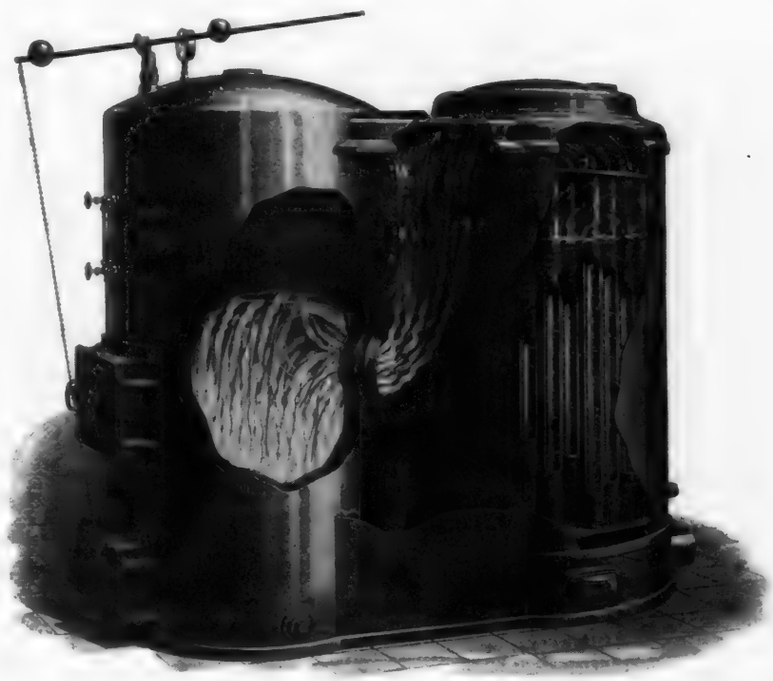
ALMOST ANYBODY CAN LAY OUT AN INSTALLATION OF AEROFIN RADIATION FOR BLAST HEATING, is the message contained in one of the latest circulars issued by the Aerofin Corporation, Newark, N. J. The circular goes on to give explicit directions for using the performance data tables on Aerofin, first, to find the number of rows required; second, the net face area; and, third, the sizes of piping needed for supply and return. The way the circular explains these points makes it well worth reading by anyone interested in blast heating.

WIDENING FIELD OF AUTOMATIC TEMPERATURE CONTROL, by Joseph Maguire, consulting engineer for the Sarco Co., 183 Madison Ave., New York, is a readable manual, reprinted by the company from *Factory*, taking up, in order, dye vat control, high explosive manufacture, milk pasteurization, nickel-plating vats, room temperature control, bleachery problems, control of keirs, paper mills, TNT, cooking of hams, temperature control in packing industries, in the lumber industry and in the oil industry, control of size in slashers and temperature control problems in the steel industry. Size 3¾ in. by 8¾ in. Pp. 8.

HOW TO WARD OFF SOUVENIR HUNTERS is the title of a booklet received from the Hoffman Specialty Co., Inc., New York, N. Y. Therein is described the Hoffman valve lock, designed to prevent theft or unauthorized removal of No. 1 and No. 2 Hoffman valves in public buildings and apartment houses. This is accomplished in a way that does not require extra tapping of the radiator. Two screws, with countersunk heads that can be turned only with a special wrench, pass through the body of the lock and are set up tight against the radiator casting. It is then impossible to remove the valve by turning, or the lock without the special wrench.



New Hoffman Valve Lock

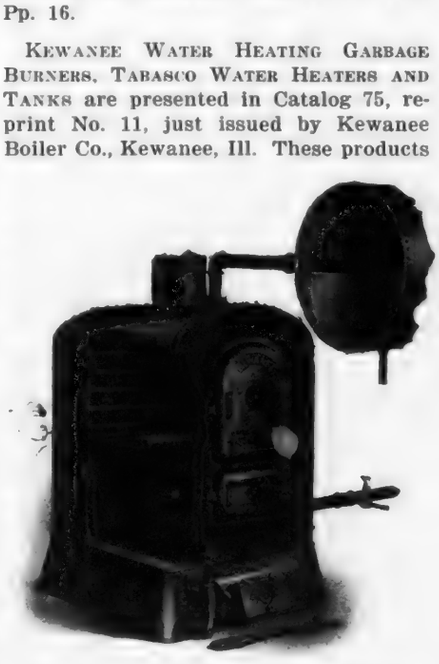


Leader Koolstack Boiler

LEADER STEEL BOILERS FOR OIL—COKE—GAS are illustrated and described in a folder received from the Leader Iron Works, Decatur, Ill. This design incorporates several interesting features, chief of which is the separation of the direct and indirect heating surfaces, each being in a vertical cylindrical shell. One shell, with firing and ash doors, provides only a combustion chamber with plain domed crown sheet, just below which is the "outlet" through which the products of combustion pass to the top of the second shell. This latter is filled with vertical fire tubes down which the hot gases pass to the boiler flue outlet at its base. By taking out the gases at this point minimum flue temperatures can be obtained. The two shells are joined for water circulation at top and bottom. An interesting feature, where oil is to be burned, is a thermostatically controlled by-pass damper between the combustion chamber outlet and the chimney by the operation of which a direct escape of gas is provided when the stack is cold, as when the burner is starting. When a temperature of 220° is reached the damper closes, sending the gases through the tube section.

ROSS STEEL HEATING BOILERS are illustrated and described in a catalog just received from Frost Mfg. Co., Galesburg, Ill. These are fire-tube boilers built of open-hearth steel, complying with the A. S. M. E. Code, and are electrically welded in all seams. Staybolts also are electrically welded. A double tier of water tubes extends over the top of the combustion chamber presenting a large surface to the radiant heat of the fire. The combustion chamber is partially divided by the arch through whose openings pass the gases distilled from the fuel in the front of the firebox. Passing over the refractory wall at the rear of the combustion chamber, the gases turn upward and then forward through the large central flue. From the front smokebox the gases pass through the fire-tubes to the bonnet at the rear of the boiler. These boilers, state the manufacturers, have proved exceptionally efficient with oil fuel on account of the generous combustion chamber and large heat-transfer areas. They are built in many sizes ranging from 400 sq. ft. to 27,000 sq. ft. capacity of steam radiation and corresponding water ratings. The catalog contains much pertinent information and many pictures and drawings. Size 6 in. x 9 in. Pp. 16.

KEWANEE WATER HEATING GARBAGE BURNERS, TABASCO WATER HEATERS AND TANKS are presented in Catalog 75, reprint No. 11, just issued by Kewanee Boiler Co., Kewanee, Ill. These products

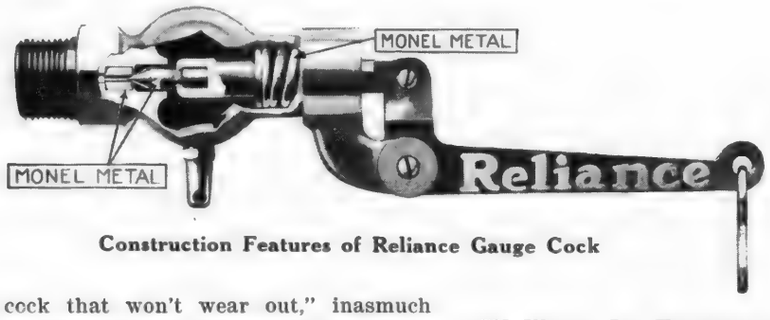


Kewanee Water Heating Garbage Burner

are described and illustrated with many illustrations, and essential, dimensional data are given. Size 6 in. x 9 in. Pp. 32.

YOUR FUEL MONEY appears on the cover of a folder issued by the Faultless Heater Mfg. Co., Waterloo, Ia. This company manufactures a heat-transfer device, called the Fuel Saver, designed for attachment to steam or hot water systems whereby the frequently-found high temperature at the boiler outlet is reduced before allowing the products of combustion to pass to the chimney. The Fuel Saver is a cast-iron radiator-like element, surrounded by a double-thickness steel housing filled with asbestos air-cell insulation. Over 25 sq. ft. of surface is provided for each cubic foot of water and, by passing the flue gases from top to bottom of the economizer, it is possible to reduce the flue gases to approximately 250° F. Fuel Savers are manufactured in fifteen sizes to accommodate smoke pipes from 10 in. to 36 in. diameter.

IMPROVED RELIANCE GAUGE COCK is featured in a small circular issued by the Reliance Gauge Column Co., Cleveland, O. This is described as "a gauge cock that won't wear out," inasmuch as the valve seat, valve point and spring are Monel metal. The body is of polished high-grade steam-bronze and is guaranteed for working steam pressures up to 425 lbs.



Construction Features of Reliance Gauge Cock

BURKE FUEL-SAVING SMOKE-PREVENTATIVE FURNACE, designated as a hand-operated stoker, is presented in a circular received from the Burke Engineering Co., Holland, Mich. The furnace consists of a basket grate, covered by a firebrick arch. Coal is fed to the feed pockets at the sides of the arch and falls by gravity onto the slanting side grates where it cokes. When more fuel is needed the coked mass is moved toward the center grates, the fresh fuel taking its place on the coking grates. In addition to sectional views of the grate in operation, drawings are included, having the appearance of blueprints, showing typical applications and accompanied by data on space requirements for capacities ranging from 5000 to 25,000 sq. ft. of steam radiation.

S-C PUMP GOVERNORS, REGULATING AND RELIEF VALVES is the designation of Bulletin No. 1000, issued by the S-C Regulation Mfg. Co., Fostoria, Ohio. This bulletin covers the S-C line of type H. P. boiler-feed pump governors for pressures up to 1200 lbs., Type A for pressures up to 150 lbs., Type B constant-discharge pressure governor, Type C constant-discharge pressure governor (or reducing valve), Type H balanced valve, Type I vacuum-pump governor and Type L differential-pressure valve. Four styles of relief valves are shown, Size 8½ x 11. Pp. 8.

S-C Relief Valve

SK WATER JET EDUCTORS, for lifting liquids, using liquid under pressure as the operating medium, are described in an engineering catalog, a new edition of Bulletin 2-M, issued by Schutte and Koerting, Philadelphia, Pa. Many of the illustrations are presented in color and portray very clearly both the principle of construction and operating characteristics of these pumps. Size 8 in. x 11 in. Pp. 32.

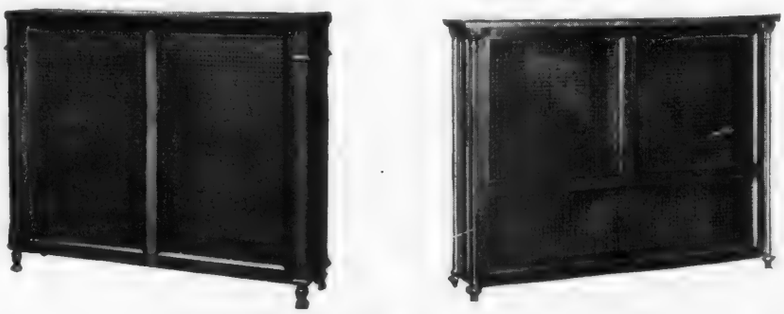
CUTTING THE COST OF HOT WATER, telling how the BST submerged water heating system maintains a constant supply of hot water in homes, apartments, office buildings and hotels without the usual "water heater" and with lower cost of fuel, is the subject of a handsomely-compiled catalog issued by Ferguson & Lange Foundry Co., Chicago, Ill. After discussing the general subject of service water heating, a description is given, with illustrations in color, of the construction and operation of BST, followed by impressive accounts of typical installations. Special display is made of the results of a test made in the Seville Hotel, Chicago, to determine the relative efficiency of a BST versus a garbage burner, indicating the steadier temperatures and economy of operation of BST. Size 8½ in. x 11½ in. Pp. 32.

W. J. BOILER AND HEATING SYSTEM CLEANSER, for steam, vapor and water heating systems, is featured in recent circulars issued by John G. Kelly, 210 East 45th St., New York. W. J. comes in liquid form and is described as free from acid or other ingredients injurious to metal. Complete directions are given in the circular for using this cleanser.

FOXBORO RECORDING GAUGES are brought to the attention of the trade in a circular issued by The Foxboro Co., Inc., Foxboro, Mass. The illustrations include a detailed view, showing the simplicity of Foxboro design, together with details of the diaphragm tube movement.

SERVING A GREAT KNOWN NEED appears on the cover of a circular sent out by the American Metal Products Corp., St. Louis, Mo., describing Kauffman radiator shields and enclosures. The radiator shields are designed to fit either high or low-type radiators and may be had in any desired finish to match the interior decoration. All joints are electrically welded. The radiator enclosures

Kauffman Radiator Enclosure, Spanish Type



Typical Kauffman Radiator Enclosures

are made of high-grade furniture steel to fit any type of radiator and are finished in wood-grained or plain finishes to harmonize with any interior. The styles of these enclosures vary from exceedingly plain to quite ornate Georgian, Italian and Spanish types. An interesting feature of this equipment is the dust catcher, which is so located that dust rising from the floor is deposited

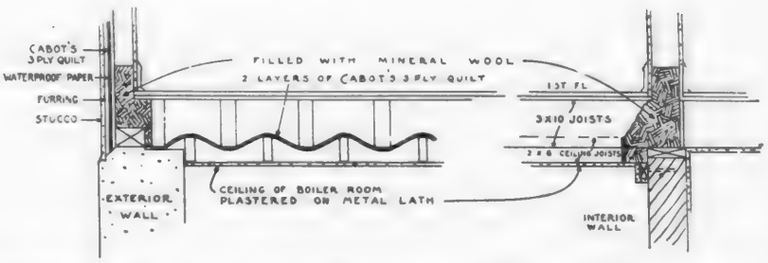


Diagram Showing How Boiler Room Containing Oil Burner Was Soundproofed

Kauffman Humidifier Concealed in Enclosure

in a channel running the length of the shield or enclosure, while the air is deflected slightly downward and out. Concealed humidifiers can also be had with any of the designs.

SARCO STEAM TRAPS are described in a unique folder issued by Sarco Co., Inc., 183 Madison Ave., New York. The little 4-page folder is cut out in the shape of a trap, the cover representing the outside; the second page is a cut-away, showing the assembly of the cartridge-and-valve element, and the third page is a cut-away of the cartridge section, showing the closed corrugated tube with the expandible fluid back of the piston which moves in the cartridge. The last page contains a brief description of the Sarco trap. It consists of a steam-pipe body, which can be screwed in a steam main or pipe occupying very little space and taking the place of an elbow or bend. In this body, a Sarco cartridge is inserted, containing a readily-expandible fluid operating a spirally-corrugated, hermetically-sealed tube, to one end of which is attached a piston which carries the valve head. The trap works automatically and as soon as water collects, the liquid contracts and the valve opens. The condensation is then ejected by the pressure behind it, and immediately the steam comes into contact with the cartridge there is an expansion and the trap closes.

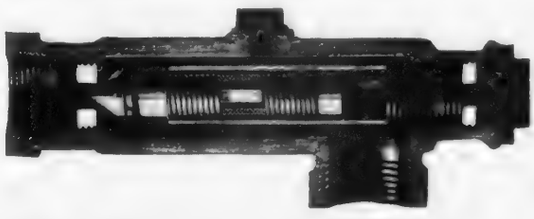
CALISCOPE, described as the instrument that accurately gives you dry and wet-bulb readings, the relative humidity and the comfort zones for any combinations of dry and wet-bulb temperatures, is featured in a catalog issued by the American Temperature Indicating Co., Toledo, O. It is the vital feature of the American system of temperature indication at remote distances. Included in the catalog is a typical specification for architects and engineers. Size 8½ in. x 11 in. Pp. 16.

REED STREAMLINE AUTOMATIC AIR FILTER is the subject of a new bulletin (No. 114) issued by the Reed Air Filter Co., Louisville, Ky., explaining in detail the development of this type, the advantages of the streamline shape for the filter itself, the method of operation, automatic control and unit construction. Included in the circular is a typical specification and dimensional and capacity data. Size 8½ in. x 11 in. Pp. 8 (punched for binding).

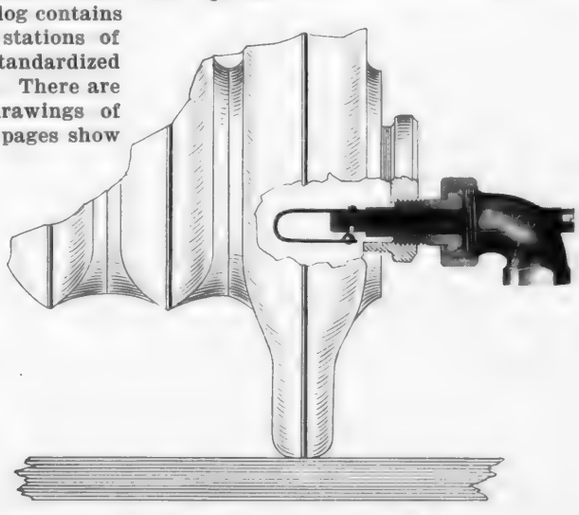
BULK STORAGE TANKS is the title of a catalog just issued by Graver Corp., East Chicago, Ind. The catalog contains many illustrations of bulk stations of every type; also a list of standardized tank sizes with specifications There are several pages devoted to drawings of bulk station layouts. Three pages show views of fittings, which Graver is prepared to furnish. Structural-steel supports are fully described on two pages. The book closes with a page on the care of tanks, with which is incorporated unloading and erecting suggestions. The catalog is attractively printed in two colors. Size 6 in. x 9 in. Pp. 48.

DEADENING THE NOISE OF OIL BURNERS is described in a circular sent out by Samuel Cabot, Inc., Boston. A specific case is cited of a home in New Rochelle, N. Y., where Cabot's "Quilt" was used, overhead and in the interior walls of the boiler room, with the result that the burner could not be heard in the room directly above. A false ceiling was built in the boiler room, using supplementary joists midway between the floor joists. The "Quilt" was woven between the two sets of timbers and the single layer was found to be highly efficient as a sound deadener.

CONSOLIDATED HEATING SPECIALTIES are described in a loose-leaf catalog recently issued by Consolidated Steam Specialty Co., Milwaukee, Wis. This company manufactures a line of heating devices, including a radiator trap of the bellows type, a thermostatic trap and a bimetallic trap in which the radiator acts as container or housing for the thermal member. There also is a return-line valve and a self-cleaning drip trap with underseat valve. The catalog is well illustrated and contains diagrams showing the installation and connections for all of the specialties. Size 8½ in. x 11 in. Pp. 28.



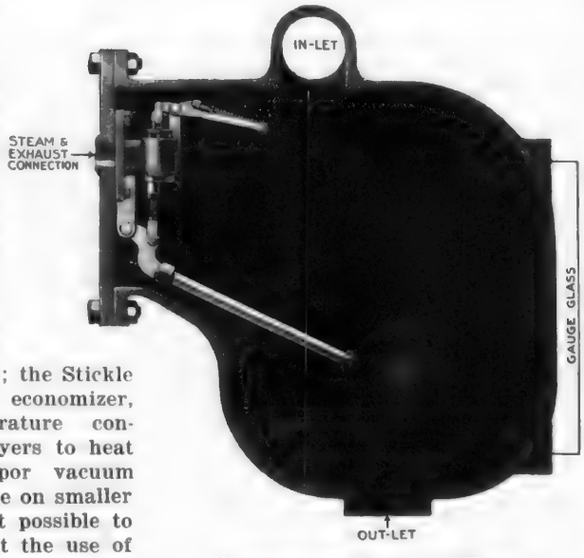
Construction Features of Sarco Steam Trap



Consolidated Radiator Trap Applied to Radiator

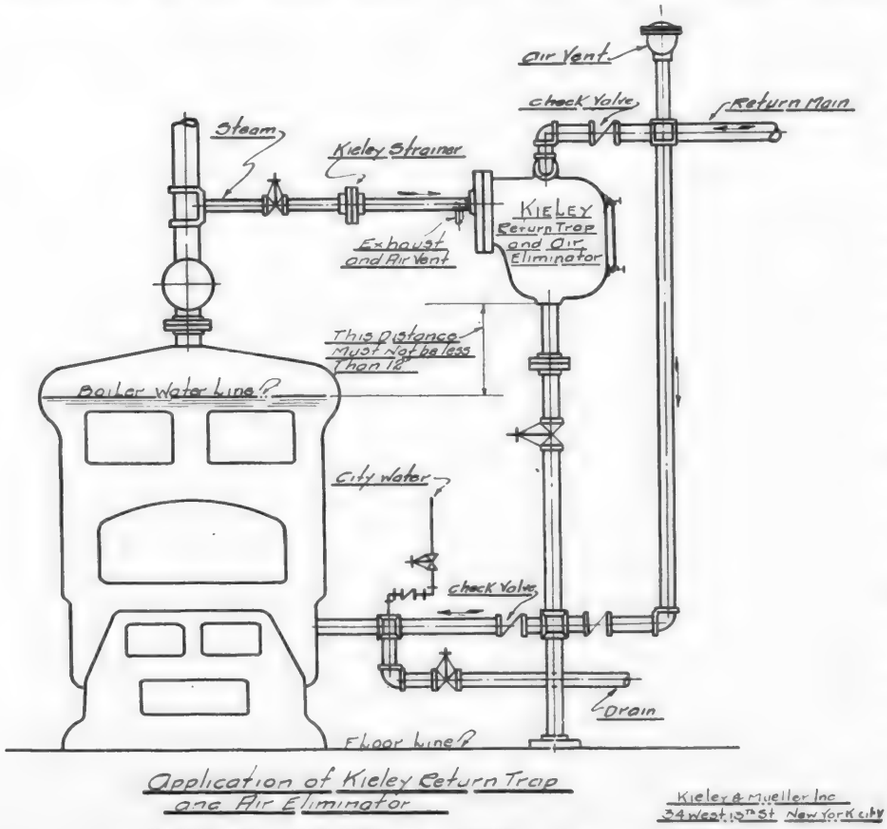
STICKLE ON "HOW TO DRY PAPER — HEAT AND VENTILATE THE MACHINE ROOM," issued by the Stickle Steam Specialties Co., Indianapolis, Ind., presents, in an effective manner, the use of the Stickle vapor vacuum blast coil, designed to utilize the high-temperature condensation from the dryers to heat and ventilate the machine room and, at the same time, to maintain a vacuum on the discharge line from the dryers; the Stickle vapor vacuum blast coil economizer, utilizing the high-temperature condensation from the the dryers to heat the air; the Stickle vapor vacuum blast unit heater, for service on smaller vacuum systems, making it possible to maintain a vacuum without the use of cooling water, and the Stickle unit heater for general industrial work. In the Stickle unit heater, the radiation is of return-bend cast-iron construction, mounted on a cast-iron base. It is in sections, screwed together with extra-heavy nipples, and made into a return loop. Each coil section is 9 in. wide, set on edge. The radiation is placed on a heavy cast-iron frame which also supports the multiblade fans with which the unit is equipped. Size 6 in. x 9 in. Pp. 20.

KIELEY LOW-PRESSURE RETURN TRAP AND AIR ELIMINATOR is described in a bulletin issued by Kieley & Mueller, Inc., New York. This device is designed for use on low-pressure heating systems and especially for vapor heating systems.



Construction Details of Kieley Return Trap

When installed on the latter, its use is designed to increase circulation and to permit efficient operation at low pressure. When the system is started in operation steam flows to the radiators, replacing air and forcing it out into the return lines to the trap. Condensate follows and is collected in the body of the trap, the air passing on out through the vent of the valve. Condensate collected in the body of the trap lifts the float and, at a certain point, operates the double-ported valve, closing the vent connection and opening the steam connection from the boiler simultaneously. The steam from the boiler quickly equalizes the pressure in the trap with the boiler pressure, and as the trap is set at a higher level than the water line of the boiler, the condensate gravitates to the boiler. As the water line drops in the return trap the float reverses the operation of the valve, closing off the steam and opening the vent, and the returns again start to collect condensate in the trap body.



Typical Application of Kieley Return Trap and Air Eliminator

ELECTRIC WELDING as carried out with equipment developed by the Lincoln Electric Co., Cleveland, O., is described in the new 1927 instruction manual issued by this company. This publication is revised every year to keep pace with the latest practices in electric arc welding, the uses of which are spreading into every phase of industry. The manual treats with all problems from the uncrating of equipment to its detailed use for every kind of work to which it is adapted. A chapter is devoted to the design of welded joints. There follows a course in various practice welds with a series of instructions in the arc welding of high-speed steel, high-pressure pipe, automobile frame, boilers, and cast-iron and manganese steel. One section is devoted to the fabrication of machine parts with standard sections electrically welded as against iron castings. As an example a machine base is shown, made up of welded structural forms, costing $7.45 and weighing 233 lbs., whereas a similar base of cast-iron weighed 560 lbs. and cost $31.70.

Welded Repair to a Vertical Boiler

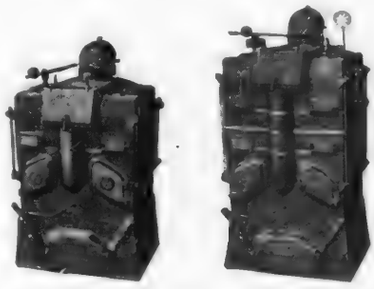
The manual is well-illustrated and forms a comprehensive text and instruction book on this subject. Size 5½ in. x 8 in. Pp. 92. Price $1.

THE WEATHER VEIN, Vol. 7, No. 1, issued by the Carrier Engineering Corp., Newark, N. J., is mainly devoted to a story of the development of the department store in the United States as exemplified by Wanamaker's, Gimbel's and the new store of J. L. Hudson Co., Detroit. Esten Bolling, in his usual facile style, tells an interesting story of the beginning and growth of the department store idea and features a de-

scription of the Hudson Building in Detroit, which is third largest in the United States and in which is done a business exceeded only by that of Marshall Field & Co., Chicago, and R. H. Macy & Co., New York. Naturally the story leads up to the determination of J. L. Hudson Company to provide its clients with "manufactured weather," this being the first great department store to utilize air conditioning for the comfort of its patrons. The installation of Carrier equipment in this magnificent building is described and well illustrated. It is announced that, with this number, *The Weather Vein* will be published quarterly on the 15th of March, June, September and December.

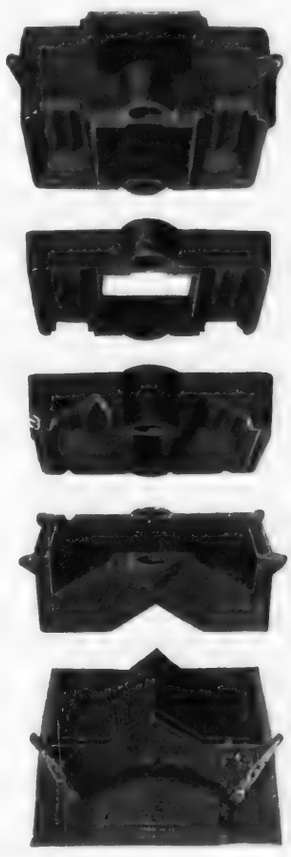
NOTHING MOVES BUT THE OIL is the title of a circular issued by the Reed Air Filter Co., Louisville, Ky., describing the Reed streamline automatic air filter. In the circular is shown a comprehensive view of a Reed air filter installation in which the air is cleaned without mechanical movement. When the ventilating fan is stopped, the pump motor starts automatically, pumping the oil from the reservoir up into the distributor at the top of the filter. From the distributor, the oil flows down over the vertical streamline-shaped tubes carrying the accumulated dust and soot down into the oil filter by gravity and the clean oil then returns to the reservoir. An electric time-relay stops the pump after it has operated for a given length of time. In average ventilating service the filter needs to be flushed but once in 24 hrs. and 2 in. is the maximum time required; thus the pump equipment seldom operates more than 10 hrs. a year, resulting in low maintenance cost.

SELF-FEED TYPE WEIL-MCLAIN BOILERS are described in a folder issued by Weil-McLain Co., Chicago, in which is



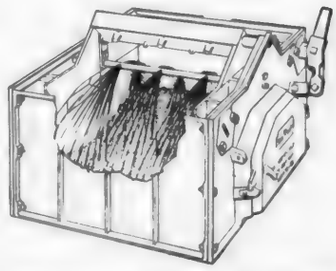
At left, 4-Section, and at right, 6-Section Weil-McLain Self-Feed Boiler

featured a cast-iron, sectional magazine boiler incorporating several new features. The boiler is made up of several sections, the lowest being a base in which the inverted V grates are set. Above this is placed a fire-pot section and then a crown-sheet element containing a corrugated surface. The boiler may then be completed with a dome section, or one or two intermediate sections may first be added. The former combination is used where the draft is bad and the latter where draft permits, in which case much higher efficiency is possible. A spray device is built into the boiler so that, through the turn of a valve, the ashes may be wetted to the desired degree before they are taken from the ash-pit. The two sets of grates are separately shaken and, in spring or fall, when heat demand is low, only one side of the boiler need be fired. Scientific design and high-class manufacture are evident from the presentation in this catalog. This type of boiler is manufactured in combinations having rated capacities from 650 sq. ft. to 2350 sq. ft., and designed for supply of from 325 sq. ft. to 1175 sq. ft. of net standing steam radiation.



Method of Assembly of 5-Section Weil-McLain Self-Feed Boiler

AUTOVENT INSTRUCTION BOOK, devoted to the solution of ventilating and unit heater problems, based upon the use of Autovent fans, blowers and unit heaters, is a useful manual published by the Autovent Fan & Blower Co., Chicago, Ill., that will be appreciated for its handy arrangement and the elimination of superfluous text. The manual gives, in concise form, with numerous illustrations of typical details, engineering information upon which air requirements for various enclosures can be calculated. Correct and incorrect methods of installation are included, showing very clearly how Autovent fans and heaters should be installed to meet various requirements. The section devoted to unit heaters opens with an exposition of a method



Ash-Spraying Device for Weil-McLain Self-Feed Boiler

of calculating heat losses and of determining proper sizes and locations of unit heaters. Among the topical headings in the manual are "The Use of Ducts in Connection with Propeller Fans," "Sizing of Grills and Register Faces," "Exhausting from Hoods and Canopies," and "Unit Heater Pipe Connections and Sizes." Sizes 8½ in. x 11 in. Pp. 24.

PYRO RADIATION PYROMETERS are described in a booklet received from Louis C. Eitzen Co., 280 Broadway, New York. These instruments are of the portable, direct-reading type, are but 7 in. long and weigh 25 oz. They operate on the principle of radiant heat, indicating the temperature by the deflection of a galvanometer needle through a current set up by a thermo-couple upon which the radiant heat is focused.

The hot body, or furnace, whose temperature is to be measured, is sighted through the eye-piece of the instrument, and when the proper setting is obtained the radiant rays are focused upon the thermo-couple which is located in the line of sight. Pressing upon a clamping button releases the needle of the galvanometer which immediately moves to

(At left) Portable Pyro Insertion Pyrometer

Pyro Radiation Pyrometer Showing Eye-Piece

the proper reading and can be held at this position by releasing the button.

A double scale is available through the use of a diaphragm, the readings being either 1000°–1800° and 1400°–2600° or 1400°–2400° and 2200°–3600°. The instruments are calibrated with tested standards and are correct within 1% of the full-scale reading. Each instrument is hand-calibrated and is accompanied by an individual test certificate.

The Pyro insertion pyrometer is another instrument of the same general type, described in another circular from the same source. This is a self-contained instrument, with a thermo-couple at the end of a tubular extension from a cylindrical galvanometer case. In this case the thermo-couple is intended to be plunged into the fluid, the temperature of which is desired. A release button on the case is pressed, allowing the needle to swing freely. The maximum deflection is reached in 6 to 8 seconds, the button is released, clamping the needle at the point indicating the desired temperature.

The insertion type is available in either of two scales, 200°–1500° for aluminum or 200°–2300° for brass, bronze and similar alloys.

North American Low-Pressure Oil Burners are described in a circular received from Louis C. Eitzen Co., 280 Broadway, New York. These burners are of the low-pressure air-atomizing nozzle type, designed to burn any available grade of heavy or light oil fuel. The oil nozzle is without crooks or bends and the air is discharged through two channels—one directed almost at right angles to the path of the oil and the other, surrounding the first, used, with a nozzle cap, to control the spread of the flame.

Arrangement of Copper Heater Tubes in Thermidaire Unit Heater

Only 6 to 8 oz. of air pressure is required and from 5 to 25 lbs. pressure on the oil. The burner is controllable from 25% to 100% of the rated capacity and is built in eight sizes, capable of handling from 9 gal. to 60 gal. of oil per hour.

The blower-motor units are direct connected, with ball bearings, and, if desired, a single blower unit can be connected to two or more burners.

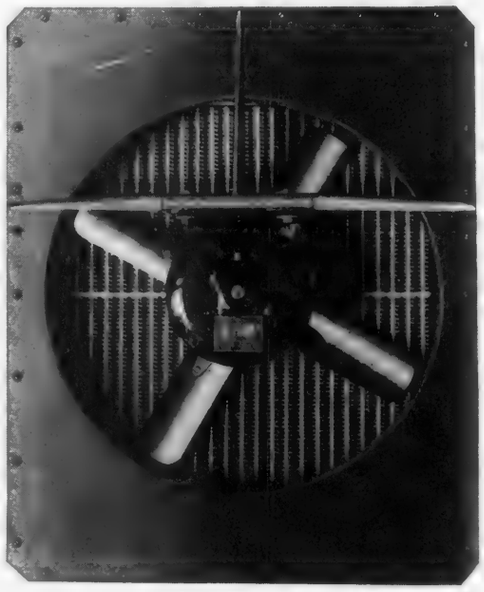
Marsh Super Line Radiator Valves are described in a catalog just received from the United States Radiator Corp., Detroit, Mich., exclusive distributors east of west lines of Michigan and Ohio, and north of the south lines of Ohio, Pennsylvania and Maryland, except New York City and Philadelphia. The catalog presents a complete line of mill-supply valves, globe valves, angle valves and gate valves, in addition to what is said to be the largest line of radiator valves manufactured. It is interesting to note the degree of standardization that has been obtained by this company by which any part, such as union nut for a given size, will interchange on every valve of the same size for the entire line. All packless stems, stuffing-box nuts, union bonnet nuts, lifting screws, and similar parts will interchange for all patterns of the same kind and size throughout the entire packless and modulated lines. These and the constructional features are well brought out by drawings, photographs and other data throughout the book. Size 7½ in. x 4½ in. Pp. 48.

Thermidaire Unit Heaters, of the self-contained type, are presented in a letter-circular, issued by the Thermidaire Corp., 2443-47 Charlotte St., Kansas City, Mo. This heater consists of a patented brass and copper radiator enclosed in a heavy sheet-metal casing which supports the motor-driven fan in the rear. Two types are furnished, Type A being designed to be suspended from the ceiling, overhead girders, main steam pipes or from center posts or side walls, and Type B being provided with a heavy sheet-metal return air duct to be set on the floor, while the Thermidaire is anchored to the top of the duct. Louvers are provided at the discharge outlet to diffuse the air currents, if desired. Oval-shaped tubing is used in the heating coils to lower the air resistance. Each tube is fitted with a brass fin, shaped similar to the blades in a turbine, and the whole treated to become practically one piece. The header for steam supply and return is made of heavy copper, and the whole heating element dipped in tin to make it leak-proof and dust-proof. Copper, tinned, and shaped to give the desired efficiency and quiet operation, is used in the disc fan blades. The central disc, to which the blades are attached, is a solid aluminum casting. Full engineering data are included for three sizes, with equivalent cast-iron direct radiation ratings ranging from 373 sq. ft. to 1075 sq. ft. The company's Chicago representative is John W. Mabbs, 431 South Dearborn St., Chicago.

Chamberlain Weather Strips are described in an interesting brochure issued by the Chamberlin Metal Weather Strip Co., Inc., Detroit, Mich. This booklet is exceptionally well illustrated and the pictures, with brief text, tell the story of the value of Chamberlin weather stripping for windows and doors. The policy of the Chamberlin Company of having weather strips installed only by its own engineers and afterward serviced by its organization, is emphasized as an important feature in getting the most out of weather stripping.

Like the Warmth of Summer Sunshine is the title of a story of oil heat as told by the W. B. Wilde Co., Peoria, Ill., manufacturers of the Hart domestic burner. The clever slogan: "Home is Where the Hart Is" runs through the brochure which is a beautiful bit of printing and photographic reproduction. The many advantages of oil as a domestic fuel are featured, photographs show Hart installations in homes of many prominent persons and in important public buildings. The brochure tells of the training that is required of every Hart dealer and of the budget-payment plan available to home-owners.

Richardson Boilerene, as manufactured by Richardson & Boynton Co., New York, is described in a circular recently mailed to the trade. This is a compound that is designed to soften hard water, prevent foaming, remove grease, oil and pipe dope from heating and plumbing systems in a few moments and thoroughly to clean the entire inside of boilers and connected pipes.



Arrangement of Disc Fan and Casing in Thermidaire Unit Heater

Present Accepted Practice in Domestic Oil Burners

Marr. *Centrifugal Atomizing, Mechanical Draft, Gas Ignition*

Previous articles in this series are:

1. *Kleen Heet, July*, 1925.
2. *Baker, July*, 1925.
3. *Kerrihard, July*, 1925.
4. *Silent Glow, August*, 1925.
5. *Aetna, August*, 1925.
6. *Caloroil, September*, 1925.
7. *Oil-O-Matic, September*, 1925.
8. *Chalmers, October*, 1925.
9. *Hart, October*, 1925.
10. *Sun, October*, 1925.
11. *Rayfield, November*, 1925.
12. *A. B. C., November*, 1925.
13. *Electrol, December*, 1925.
14. *Grant, January*, 1926.
15. *Nu-Way, January*, 1926.
16. *Wayne, February*, 1926.
17. *May, February*, 1926.
18. *Ray Rotary, March*, 1926.
19. *Super Oil Heator, May*, 1926.
20. *Nokol, July*, 1926.
21. *Johnson, August*, 1926.
22. *Arrow, September*, 1926.
23. *Safe Fire, October*, 1926.
24. *Sword, November*, 1926.
25. *Hardinge, January*, 1927.
26. *Petro, February*, 1927.
27. *Sundstrand, March*, 1927.
28. *Northern, May*, 1927.
29. *Vesta, June*, 1927.

30. Marr

THE Marr Oil Heat Machine is a completely automatic type of burner, with vertical cup-atomizer, manufactured by the Marr Oil Heat Machine Corp., Minneapolis, Minn. Development dates back some six years and the burner was first produced in essentially the same form as manufactured to-day; only details have been changed.

The burner is constructed in a single unit, installed partially within the ash-pit of the boiler, with the top of the atomizing cup located in the plane of the grate top; the motor and auxiliary devices are attached to the same bed plate, but are outside of the boiler lines. The motor is horizontal and drives the cup through a horizontal shaft, a pair of right-angle spiral gears and a hollow vertical shaft.

HOW COMBUSTION IS SECURED

Oil is fed to the bottom of the atomizing cup through a fixed stand-pipe extending up through the hollow drive shaft. The cup, driven at a speed corresponding to its diameter to secure the desired peripheral speed, throws the fuel from its edge in a horizontal sheet, gasification being effected close to the rim. The combustion chamber is a cast-iron circular bowl, shallow, and of as great a diameter as the boiler permits. It is fabricated in two parts to facilitate installation. This bowl is lined with special plastic refractory material materially aiding gasification.

The rotating cup has radial blades cast on its under surface and these act as a fan to supply the primary air. A collar-like damper is placed around and below the cup, by means of which this air flow is set to correspond to the setting of the oil feed for the particular installation.

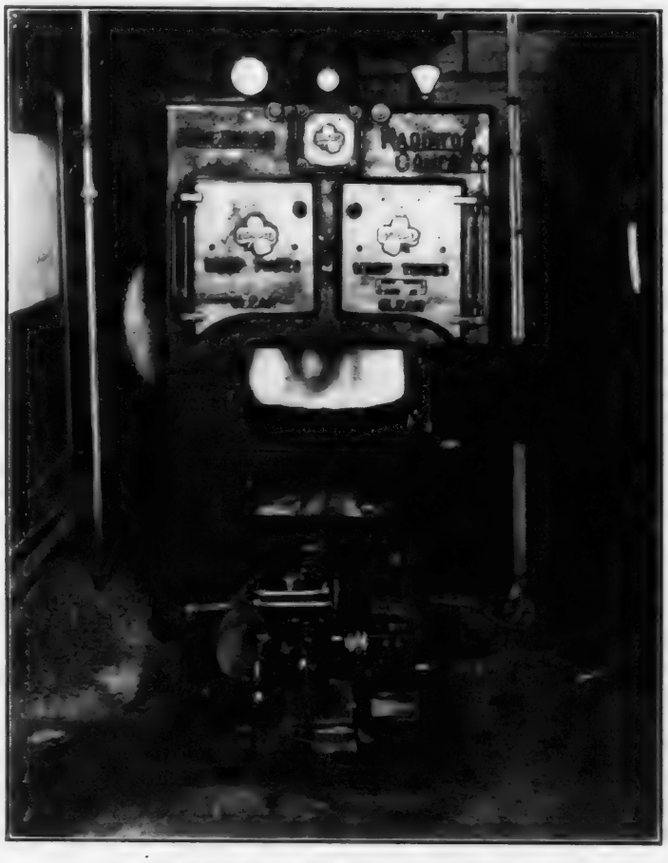
The result of this design is to produce a flat circular flame at grate level, yet with no chance for the flame to impinge upon the boiler surfaces, as it is turned upward by the shape of the combustion bowl. The quickness with which the comparatively thin refractory lining of the bowl heats up, its high heat-refracting ability and the flow of oil-gas and air close to and parallel to its surface, insure rapid gasification and easy maintenance of combustion temperatures within the confines of the combustion bowl. The result is a minimum tendency to permit the escape of free carbon.

HOW THE BURNER OPERATES

The motive power for the atomizing cup and the pumps is a Century ¼ H.P. repulsion start, induction motor, which requires such a low starting current that it is installed with 10 ampere fuses. It is built with large lubrication reservoirs requiring filling but once a season. In addition to driving the atomizing cup this motor operates a rotating-oscillating oil pump, capable of drawing against a 20-in. vacuum. This pump delivers oil from the storage tank to a 1-gal. tank located on the burner base. Before reaching the pump, the oil passes through a 70-mesh screen of large area. The fact that the pump does not operate against head pressure, coupled with very accurate construction and self-lubrication, insures long life and little chance for trouble.

From the top of the little oil tank the surplus oil is returned to the storage tank. From its bottom the supply for the burner is taken by a gear pump and forced through a special control valve to the stand-pipe in the burner head. The function of this little service tank is to maintain an appreciable quantity at the burner for immediate starting; also it provides against a "jumpy" fire caused by air bubbles often present in a fuel line when the pump is first started.

A shut-off valve actuated by a ball governor is between the gear pump and



A Typical Marr Oil Burner Installation

the stand-pipe. When the burner is started this valve is held shut until a pump speed of 1200 r.p.m. is reached, when the opening is instantaneous and no oil is delivered to the atomizing cup until the air necessary for its complete combustion is available. This valve is self-cleaning as its moving member rotates and wipes off its seat when starting and stopping. Both of these elements are of steel, hardened and ground in.

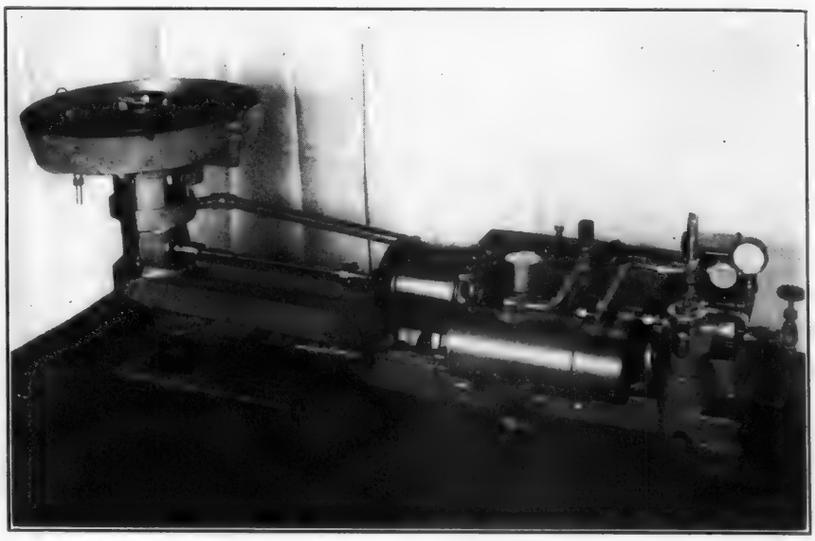
The construction of the burner head evidences careful design, the selection of the best available materials and superior workmanship. The spiral driving gear is of Texolite, a development of the General Electric Company, and the driven gear is steel. The bearing on the motor shaft is of special bronze, and the step bearing and main bearings of the vertical shaft are ball. The housing of the head is oil-tight, with 2-qt. capacity. As this part of the burner is kept cool by the circulation of air this oil is not subject to deterioration by heat and one filling is sufficient for an entire season. An oil gauge and filling cap outside of the boiler line permit of easy inspection and replenishment.

A Honeywell stack control functions in connection with a motor program switch of the same make, the latter controlling an expanding gas pilot flame, located in a recess in the rim of the combustion bowl. There also is an interlocking boiler pressure or temperature control. An overflow-actuated safety functions through a Mercoid tube in case of oil supply without the accomplishment of ignition. This is operated by oil caught in the combustion bowl and carried to the float chamber through a ¾-in. pipe. This part of the mechanism is designed to be unaffected by any sulphur that might be in the oil.

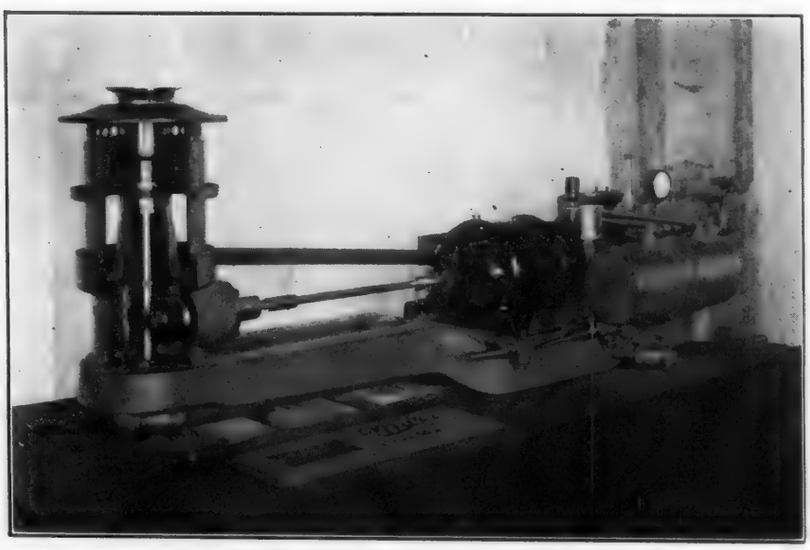
One feature of the design that was kept in mind from the first is provision for easy replacement or adjustment of any part without disturbing other elements.

Provision for material variations in load is made by designing four sizes of atomizers, the rated capacity of the largest being 10,000 sq. ft. of boiler capacity. The smallest cup has a minimum capacity of ¾ gal. of fuel per hour and the largest will handle 15 gal. per hour.

The Marr Oil Heat Machine is listed by the Underwriters to burn oil not heavier than 28° A.P.I., and is also listed as standard by the Board of Standards and Appeals of New York City.



Marr Oil Burner Showing Driving Motor, 1-Gal. Service Tank, Oil Pump, Strainer and Overflow Tank



A Cut-Away Marr Oil Burner Showing Detail of Burner Head

Engineers, Civic Leaders and Medical Men Discuss Smoke Abatement

The great importance of the campaigns for smoke abatement that feature many American civic activities, was emphasized and the subject greatly clarified through the presentation of three papers, bearing on this subject, at the last annual meeting of the American Society of Mechanical Engineers, in New York

W. C. White, pathologist, U. S. Public Health Service, and chairman of the Medical Research Committee, National Tuberculosis Association, in a paper "What is Known About the Effect of Smoke on Health," presented a very clear story of the physiological effect of smoke on the human being.

"Smoke Abatement,—Its Effects and Its Limitations" was the subject of a paper presented by H. B. Meller, bureau chief, Bureau of Smoke Prevention, Pittsburgh, and Osborn Monnett, consulting engineer, Chicago, described "The Present Status of the Smoke Problem."

The discussion that followed the presentation of these papers was participated in by many notables in the scientific, engineering and medical professions.

A constructive thought that appealed to several later speakers came from A. G. Christie, professor of mechanical engineering, Johns Hopkins University. This was the joining together, in any community, of interests controlling the smaller plants whose individual resources did not permit the employment of competent combustion engineers to prevent smoke purely in the interests of economy. Professor Christie suggested that such a group could often afford to employ the best technical skill and that the savings would be material because the smaller plants were usually the worst offenders. Among those entering into the discussion of these papers were: H. W. Clark, University of Utah; B. J. Merkt, industrial engineer, Brooklyn Union Gas Company; E. J. Kunze, associate editor, *Power Plant Engineering;* Dr. Jerome Meyers, Bureau of Industrial Hygiene, New York City Board of Health; Prof. A. R. Acheson, Syracuse University; Dr. Carey J. Vaux, director, Department of Public Health, Pittsburgh, and Dr. E. R. Weidlein, director, Mellen Institute, Pittsburgh.

FOR COMPLETION IN 1927

885 PARK AVENUE

888 PARK AVENUE

It is *Conscientious Purpose* which turns *Work* into *Art*

A GROWING demand for finer commercial and residential structures is setting an exacting standard for builders, with the result that greater attention is being given to architectural treatments, quality of construction and conveniences.

Paralleling the gigantic progress of the building industry is the developed appreciation of the public for the beautiful.

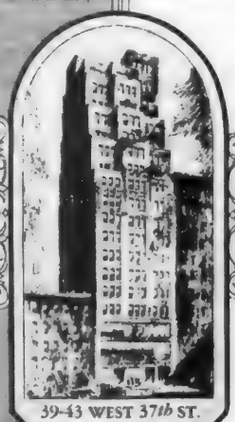
Building construction is fast combining industrial science with art. But buildings reflecting finished craftsmanship are the result only of long experience and conscientious purpose.

More than a quarter century ago, Julius Tishman & Sons, Inc., launched their first constructional enterprise, resolving then, in 1898, to make "Conscientious Purpose" the cornerstone of each new structure. For nearly thirty years they have endeavored in the construction of many business buildings and apartment homes to master the science and art of planning, building and property management.

Seven new structures, three commercial and four Park Avenue apartments, will reach completion in 1927

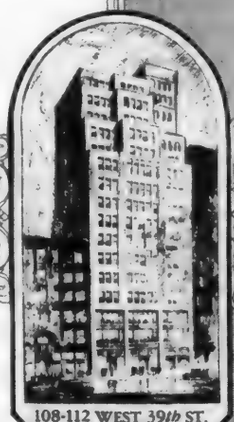
125 EAST 84*th* ST.

1125 PARK AVENUE



39-43 WEST 37*th* ST.

48-56 WEST 37*th* ST.



108-112 WEST 39*th* ST.

JULIUS TISHMAN & SONS
INCORPORATED
Owners and Builders
285 MADISON AVENUE
NEW YORK

More proof that Illinois Vapor Systems enjoy a remarkable record for repeat orders among discriminating owners and builders.

Write for "Vapor Details" Bulletin 22 (AIA 30c2)

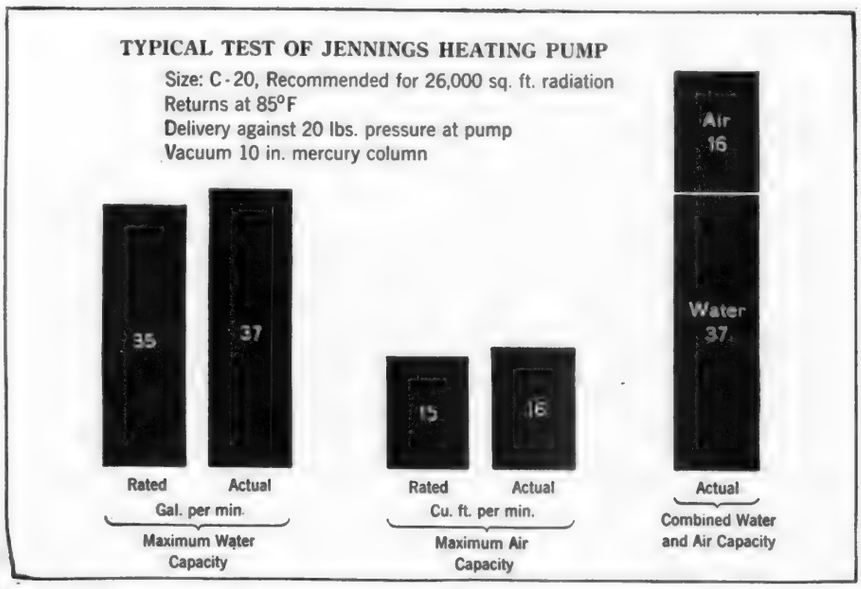
This facsimile of a page from the New York Herald-Tribune shows a group of notable buildings, all equipped with Illinois Vapor Systems.

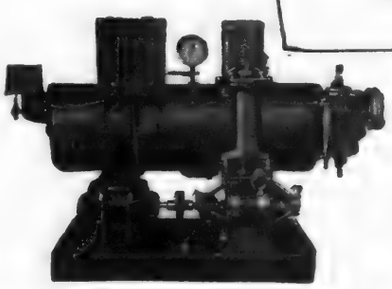
ILLINOIS ENGINEERING COMPANY

ROBT. L. GIFFORD. PRES. INCORPORATED 1900

BRANCHES AND REPRESENTATIVES IN 40 CITIES

CHICAGO





Motor-driven Jennings Vacuum Heating Pump with Returns Tank. Supplied in sizes up to 300,000 sq. ft. equivalent direct radiation; for either continuous operation or with automatic control.

Combined water and air capacity is what counts—*not* capacity to pump water or air alone

Test any Jennings Vacuum Heating Pump for maximum water capacity only. Then for maximum air capacity only. And finally for combined water and air capacity under the specified conditions of vacuum, pressure and temperature for which the particular size of Jennings unit is recommended.

Two things will at once be apparent. That the actual maximum water and air capacities of the Jennings Pump are the same as, if not greater than, the published rated capacities.

And further,—that the actual combined water and air capacity also is fully as great as the combined rated capacity.

It is this combined capacity in actual service which affirms the efficiency of the Jennings Pump. And identifies its exceptionally economical performance in removing condensation and air from the return line heating system.

NASH ENGINEERING COMPANY

81 WILSON ROAD **S. NORWALK, CONN.**

Branch Sales Offices: Atlanta, Birmingham, Boston, Buffalo, Chattanooga, Chicago, Cleveland, Dallas, Denver, Detroit, Indianapolis, Kansas City, Memphis, Miami, Minneapolis, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Richmond, St. Louis, Salt Lake City, San Francisco, Seattle, Tampa, Washington, D. C. **In Canada:** Montreal, Toronto and Vancouver. **European Offices:** London, Eng., Norman Eng. Co.; Brussels, Belgium, and Amsterdam, Holland, Louis Reijners & Co.; Oslo, Norway, and Stockholm, Sweden, Lorentzen & Wettre.

Jennings Pumps

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Trade and Miscellaneous Notes

Coming Events

October 12-16, 1927. Ninth annual convention of the American Gas Association at Chicago, Ill. Headquarters at the Hotel Stevens.

October 17-21, Fifty-sixth annual convention of the American Public Health Association, at Cincinnati.

Miscellaneous Notes

Building Operation for May, 1927, as reported by the F. W. Dodge Corporation, showed an increase of half of 1% over 1926. The figures for 37 States are $552,348,500. Of this amount 40% was for residential buildings; 20% for public works and utilities, 13% for commercial buildings, 8% for industrial buildings and 6% for educational buildings.

Bancroft Gherardi, vice-president and chief engineer of the American Telephone and Telegraph Co., New York, was elected president of the American Institute of Electrical Engineers at its annual business meeting.

F. A. Sutherland, of Saginaw, Mich., was appointed an official measurer of furnaces for the National Warm-Air Heating and Ventilating Association, at its last convention held in Cleveland.

Robert T. Kent has been appointed general manager of the Bridgeport Brass Co., Bridgeport, Conn. Mr. Kent is the son of the author of "Kent's Mechanical Engineers' Handbook," and is himself the editor and reviser of tne tenth edition of the book.

Rufus Richart, a graduate of Dartmouth College, has been named as assistant director of the Oil Heating Institute of the American Oil Burner Association. Mr. Richart has had a wide experience, since graduation, with the General Electric Company, doing publicity work.

Harry F. Tapp, a graduate of Pratt Institute, Brooklyn, has been appointed technologist of the American Oil Burner Association, succeeding C. F. Olmstead, who recently resigned. After completing a course in mechanical engineering, Mr. Tapp was, for three years, with the Otis Elevator Company. For nearly four years he was associated with the Socony Burner Co., New York, and was there engaged in engineering and development work on both domestic and industrial burners. Mr. Tapp's extensive experience in oil-burning work and his previous engineering training will make him a valuable acquisition to the staff of the association.

Heating and Piping Contractors Cincinnati Association held its annual picnic, June 16, at the Homestead Golf Club, North College Hill. The program included a golf tournament, which was in charge of E. J. Niemes; a baseball game, staged under the direction of Hugh O'Hara, and other athletic events. Eighty-seven representatives of the heating industry in Cincinnati were present. Among the out-of-town guests was Cliff W. Presdee, western manager of THE HEATING AND VENTILATING MAGAZINE, who was called upon for an after-dinner speech at the conclusion of the day's festivities.

L. H. Prentice Co., Chicago, Ill., heating and ventilating contractors, whose fiftieth anniversary is being celebrated this year, has issued a souvenir book dealing with its history and the many notable heating and ventilating installations for which the firm has been responsible during that

A New Catalog is ready!

Catalog 110

—featuring—

Uniblade Blowers & Autovent Fans

Now ready for distribution!

A BOOK that completely covers the subject of VENTILATION. It tells how to figure air requirements, determine blower sizes and duct measurements.

A BOOK that lists a complete, well designed, well-built line of Uniblade Blowers and exhausters. From the tiny No. 00 Blower to the large No. 10, the one handling 100 C.F.M., the other a thousand times that amount. Constant speed machines and variable speed units, both motor or pulley driven types are shown.

A BOOK that you will want because you will find it to be of great value. Aside from the extensive listing of Uniblade Blowers and Exhausters contained therein, several pages are devoted to a showing of Autovent Propeller Type Fans and Unit Heaters.

Your copy is ready. Send for it today!

(Attach to your letterhead and MAIL!)
YES! We want a copy of your new Catalog 110 on our desk. Please send it along at once.
Mark it for—

AUTOVENT FAN & BLOWER CO.
730-738 W. Monroe St., CHICAGO, ILL.

AUTO [Automatic] VENT [Ventilation]
[GUARANTEED]

period. In this connection the company is now completing one of the largest piping jobs ever installed, that for the North Side Sewage Treatment Works, at Niles Center, Ill., which involves more than 12 miles of wrought-iron pipe. Harry Hart, who is president of the company, has just been re-elected president of the Heating and Piping Contractors National Association. He first joined the firm as draftsman. The other officers are Edward Wilson, vice-president and general superintendent, whose career has been devoted almost entirely to the company as superintendent of the sheet-metal department and as assistant superintendent of the steam fitting department; and Frank A. Hayes, secretary and treasurer, who joined the company in 1906, serving first in the engineering and estimating departments. L. H. Prentice, who, with Alexander Hay, founded the company in 1877, retired in 1922.

American Institute of Refrigeration is the name under which the American Association of Ice and Refrigeration will be known hereafter. The change was made at the annual meeting of the association, in Washington, May 5-6. It was felt that the new name is more appropriate as it will permit the association to enlarge its activities and take into its membership individuals and firms who properly were not eligible as the association was previously constituted. It was also felt that the word "association" is more properly identified with a trade body.

Natural Gas Association of America has voted to merge with the American Gas Association. This action was taken at the association's annual meeting in Cincinnati, May 10. The Natural Gas Association committee on the desirability of the affiliation, consisting of H. C. Cooper, R. W. Gallagher and A. W. Robertson, had agreed upon a tentative basis of amalgamation with the A.G.A. committee, the members of which were Harry C. Abell, George N. Whitwell and Clare N. Stannard. Investigation showed that practically all the problems in the natural gas industry are similar to those of the manufactured gas industry, with the possible exception of matters pertaining to the production of gas.

House-heating with Gas was given a prominent place in a two-weeks' course in industrial gas engineering, conducted at the University of Illinois last month, under the auspices of the Illinois Gas Association. Demonstrations were given on gas-fired heating equipment and on the use of insulating materials.

Arno C. Fieldner, superintendent of the United States Bureau of Mines Experiment Station, in Pittsburgh, has been appointed chief engineer of the Division of Experiment Station of the bureau, embracing eleven experiment stations located at various points throughout the country.

Manufacturers' Notes

Minneapolis Heat Regulator Co., Minneapolis, Minn., held its annual sales convention in the auditorium of its new factory building and all branch managers and district representatives of the company were present. Much attention was attracted by the floodlighted tower of the building.

L. J. Mueller Furnace Co., Milwaukee, Wis., following the introduction to the gas industry of the Gas-Era boiler, has secured as district managers Reid A. Cameron and R. B. Russell, in the Gas Sales Division. Mr. Cameron, formerly general sales manager of the Pittsburgh Water Heater Company, will act as manager of the Chicago district, with headquarters in that city. Mr. Russell will manage the Kansas-Oklahoma district for the company, and will make his headquarters in Kansas City, Mo.

Frost Mfg. Co., Galesburg, Ill., manufacturer of the Ross steel heating boilers, has appointed the Ross Boiler Co., 101 Park Ave., New York, as eastern sales representative. Llewel-

PECCO

UNIT HEATERS

The Heat that Pays!

Pecco Unit Heaters, projecting just the proper amount of heat where it will do the most good, reduce sickness, irregularity and discontent among the employees and assure a maximum production.

The amount of warm air from each outlet can be regulated, and the outlets can be adjusted to deliver warm air in as many different directions as desired.

The position of the heating coils in the upper part of the heater make it an easy matter to run return lines back to the boiler.

The great capacity and adaptability of Pecco Heaters assure the uniform Heat that Pays.

Write for Free Book "Pecco Unit Heaters."

FOR USE IN:

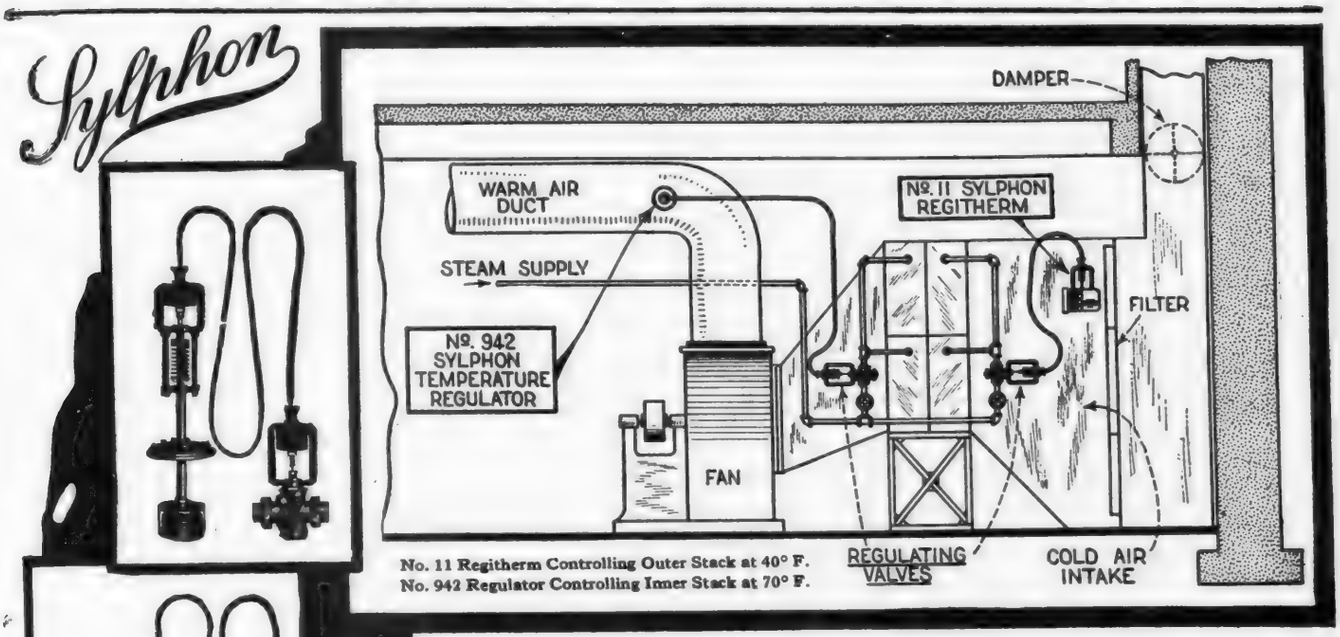
Woodworking Plants
Garages & Auto Sales
Machine Shops & Metal Working Plants
Laundries
Drying
Shoe Factories
Foundries & Forging Plants
Apartment House Garages
Theatres & Gymnasiums
Paper Mills
Warehouses
Soap Manufacturers
Printing Plants
Painting Shops
Stone Yards
Packing Plants
Dairies
Bleacheries & Dye Works

This external view shows some Pecco Unit Heater features. Note that the cold air intake fan is located where it belongs —near the floor at the cold air level.

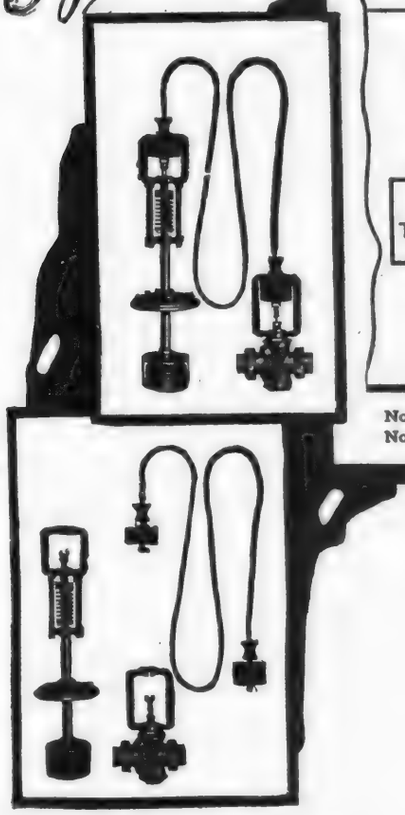
Heat With Unit Heaters!

PECCO, INCORPORATED, 2980 North Market Street, St. Louis

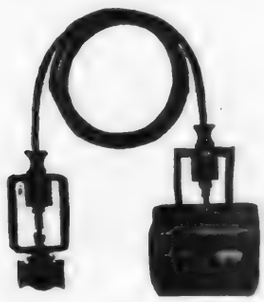
Sylphon



No. 11 Regitherm Controlling Outer Stack at 40° F.
No. 942 Regulator Controlling Inner Stack at 70° F.



No. 942 Sylphon Temperature Regulator, assembled above, and unassembled below, showing how easily the transmission unit is detached or connected to the valve and thermostatic head by means of T-slot connections.



No. 11 Sylphon Regitherm with separable transmission unit, connected as in No. 942.

This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THIS ALL METAL, SEAMLESS SYLPHON BELLOWS
Sylphon

Every genuine Sylphon bellows is drawn and formed seamless from a flat sheet of specially prepared metal, with folds or corrugations formed to provide the greatest strength and flexibility.

Automatic Temperature Control for Indirect Heating Systems

In the installation shown above, a No. 11 Sylphon Regitherm (set at 40° F.) controls the steam supply to the outer heating stack. Whenever the outside temperature falls below 40° F. the Regitherm automatically opens the steam supply to this stack, supplementing the No. 942 Sylphon Regulator which is installed on the inner stack and maintains the warm air supply in the duct at 70° F.

Easy to Install, Dependable

The three-part construction of these two Regulators makes installation an easy matter, because only one part has to be handled at a time.

The well-known Sylphon Bellows is the expansion unit in these instruments. Thus the power required for their operation is generated within the regulator. There are no delicate or complicated auxiliaries to get out of order. You can safely install these simple, sturdy instruments for they will work without attention season after season, automatically maintaining 70° F. heating conditions, no matter how much the outside temperature may vary.

Ask for Bulletin WR-102 or Bulletin WTR-110 giving prices, dimensions, and many interesting detail drawings of installations.

The Fulton Sylphon Company

Originators and Patentees of the Sylphon Bellows

Knoxville, Tennessee, U.S.A.

Sales Offices in: New York, Chicago, Detroit, Boston, Philadelphia and all principal cities in the U. S.

European Representatives:
Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W. 1, England

Canadian Representatives:
Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

lyn Moore, formerly of W. A. Case & Son Mfg. Co., New York, and John W. Meierdiercks, formerly of Abendroth Bros., Port Chester, N. Y., comprise the Ross Boiler Company.

Burnham Boiler Corp., Irvington, N. Y., has appointed A. H. MacDade in charge of sales at the Philadelphia office in the Bourse Bldg., 4th St. near Market. Another appointment is that of Adna F. Johnson as western sales manager of the company, with headquarters at the Chicago office, 220 South State Street. Mr. Johnson has been in charge of sales in southern Ohio for the past several years. A complete warehouse stock is carried at Philadelphia and Chicago.

Pacific Steel Boiler Corp., Waukegan, Ill., announces the appointment of the Kelsey Heating Co., 294 James St., Syracuse, N. Y., as sole distributor in the Syracuse territory.

U. S. Radiator Corp., Detroit, Mich., has leased for a long term of years, the new fireproof warehouse now nearing completion in Vassar St., Cambridge, Mass. The building contains about 20,000 sq. ft. of floor space with railroad siding. The company will retain its present warehouse in South Boston.

Garrison Fire Detecting System, Inc., 79 Madison Ave., New York, announces the election of Walter Rawlings Hough as vice-president of the company. Mr. Hough is president of the Board of Fire Commissioners of Baltimore, and chairman of the Fire Commissioners' Section of the National Fire Protection Association.

Cochran-Sargent Co., St. Paul, Minn., has moved into its new building at Third and Broadway, and celebrated the event by tendering a reception and "open house" to the St. Paul retail trade, and also to architects, engineers, jobbers and manufacturers' representatives in St. Paul and Minneapolis.

Honeywell Heating Specialties Co., Wabash, Ind., has acquired two new plants which give 26% increase in manufacturing floor space. The company now operates four plants, and its officials are planning to increase the personnel 35% over last year.

Sarco Co., Inc., 183 Madison Ave., New York, held its annual sales convention, June 2 and 3, at the New York office, which was attended by all of the company's salesmen. C. Wells, president, and E. J. Ritchie, general sales manager, presided at the convention, following which a trip was made to the Sarco plant at Bethlehem, Pa.

Lincoln Electric Co., Cleveland, O., announces the following changes and additions to the sales and service department: L. P. Henderson, formerly with the Detroit office, has been transferred to Chicago in charge of welder service; J. E. Durstine, from the experimental engineering department to welder service department at Cleveland; J. W. Shugars, of the time study department at Cleveland, and R. D. Layman, have been moved to Detroit under the direction of J. M. Robinson; D. H. Carver, from the machine shop division at Cleveland, to the Ohio service division at Cincinnati; R. F. Terrill, from the general engineering department at Cleveland to the eastern service division at New York.

A recent appointment made by the company is that of the Wade Engineering Co., 1855 Industrial, St., Los Angeles, Calif., as distributor of Lincoln products in California. Henry N. Wade, president, is in charge of this office This company maintains a branch at 69 Webster St., Oakland, Calif., with H. T. Lintott, in charge.

Pierce, Butler & Pierce Mfg. Corp., New York, has appointed Herbert Letcher manager of its Cleveland branch, at 5201 Hamilton Ave., Cleveland. Mr. Letcher for the past ten years has been connected with the sales department of the Mill & Mine Supply Company, now the Akron branch of the Pierce, Butler & Pierce Mfg. Corporation.

YEOMANS

YEOMANS PUMPS GIVE YEOMAN SERVICE

HORIZONTAL AND VERTICAL AUTOMATIC ELECTRIC

Condensation Pumps

A thorough investigation of this pump will reveal the best material, the finest workmanship, resulting in a noiseless, rugged, reliable product that will give dependable service for many years.

For automatically returning condensation to boilers from low pressure gravity steam heating systems.

Also manufacturers of Bilge Pumps, Centrifugal Pumps, Sewage Ejectors, Sewage Pumps, etc.

Engineers and architects may for the asking receive our condensation bulletin.

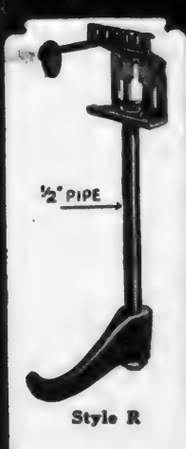
YEOMANS BROTHERS COMPANY
1421 Dayton St., Chicago
Representatives in all principal cities

7

E Z

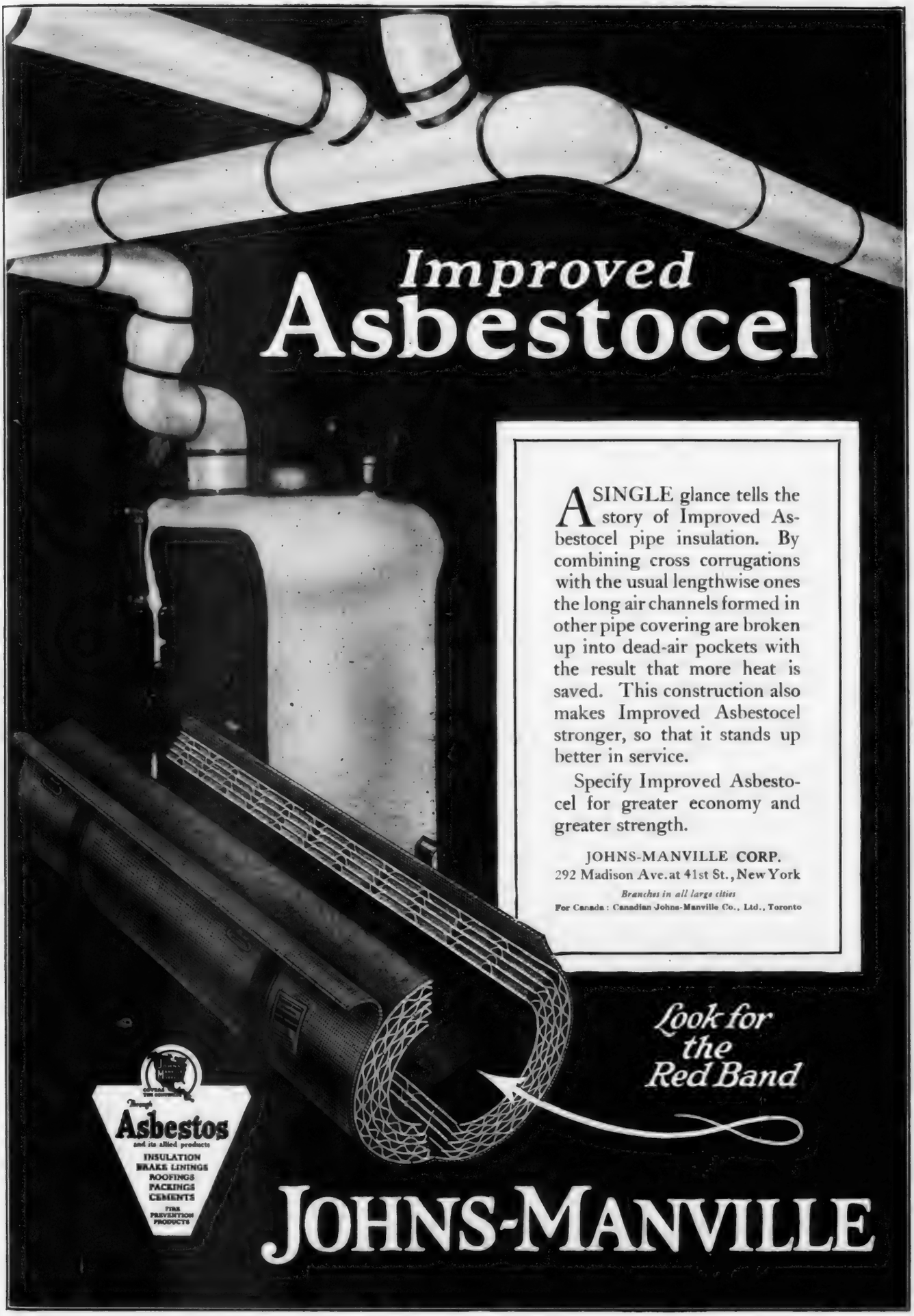
RADIATOR HANGER

We can ship from stock E-Z Hangers suitable for *All* makes of the new Tube Type Radiators.



Style R

HEALY-RUFF CO.
772 Hampden Avenue
ST. PAUL, MINN.


Improved
Asbestocel
A SINGLE glance tells the story of Improved Asbestocel pipe insulation. By combining cross corrugations with the usual lengthwise ones the long air channels formed in other pipe covering are broken up into dead-air pockets with the result that more heat is saved. This construction also makes Improved Asbestocel stronger, so that it stands up better in service.
Specify Improved Asbestocel for greater economy and greater strength.
JOHNS-MANVILLE CORP.
292 Madison Ave. at 41st St., New York
Branches in all large cities
For Canada: Canadian Johns-Manville Co., Ltd., Toronto
Look for the Red Band
Asbestos
and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS
JOHNS-MANVILLE

Big Three Welding & Equipment Co., Fort Worth and Houston, Tex., distributor for Lincoln Electric Company "Stable-Arc" welders, announces the opening of its third warehouse branch at 1 North Frankfort St., Tulsa, Okla.

York Heating and Ventilating Corp., Philadelphia, Pa., has appointed C. H. Israel, Jr., to the company's Philadelphia district sales force. Mr. Israel was formerly connected with the Harrisburg Foundry & Machine Works. He received his chemical engineering degree from Lehigh.

Illinois Malleable Iron Co., Chicago, Ill., has purchased and adapted two new stores for the accommodation of city trade. One store located at 7720-22 South Racine Avenue will be the south branch, and the other, at 5001-3 West Lake Street, will be known as the west branch.

Quigley Furnace Specialties Co., 26 Cortlandt St., New York, has appointed Harrison W. Wood as a member of the service staff, to cover the central South and south Atlantic States. With headquarters in Atlanta, Mr. Wood will cooperate with all Quigley agents in that territory.

S. C. Bloom & Co., 53 West Jackson St., Chicago, announces that W. H. Motz, formerly technical engineer of the Hill Mfg. Company, Chicago, is now serving in the capacity of research engineer of the Bloom company.

United States Radiator Corp., Detroit, Mich., has opened a new branch house at 1430 Avenue B South, Birmingham, Ala., which is intended to serve the southern territory from Louisiana to the Atlantic Coast. A. F. Westerfield has been appointed manager of the new branch.

Yeomans Brothers Co., 1433 Dayton St., Chicago, announces the following new representatives to handle the Yeomans line: Texas Engineering Co., 925 Electric Bldg., Houston, Tex.; Dillard Engineering Co., 612 Construction Industries Bldg., Dallas, Tex.; Heating and Ventilating Equipment Co., Builders and Traders Exchange, Grand Rapids, Mich.

C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., has opened a branch factory at 5902 Carnegie Ave., Cleveland, O. The prime function of the new factory will be repair work, with special attention to emergency orders. In addition to these facilities, there will be maintained stocks of all standardized instruments. This branch factory will be in charge of A. R. Anderson, district manager, F. A. Denz, F. L. Frock and F. Cramer.

General Air Filters Corp., 110 West 42nd St., New York, has appointed the Dingle-Clark Co., 311 Ross St., Pittsburgh, as representatives for ACE automatic self-cleaning air filters, unit-type stationary air filters, compressor-type air filters for air compressors, internal combustion engines and electric motors, and air washers, spray nozzles and spray ponds.

James P. Marsh & Co., 114 South Clinton St., Chicago, Ill., announces the opening of a New York office in the French Building, 551 Fifth Avenue, with R. S. Gaisford as manager. This company is manufacturer and distributor of automatic air valves, steam specialties, gages, thermometers, pop safety and relief valves, and Beaton & Corbin floor and ceiling plates.

Caloroil Burner Corp., New York, has fostered three sectional dealer sales meetings, one in Albany, another in New York City, and the third in Philadelphia. These meetings were attended and addressed by George Bullock, president, and G. N. Rittenhouse, director of sales.

Crane Co., Chicago, has opened a new office and display rooms in Boston, at 799 Boylston Street. The local warehouse will remain at 48 West First Street.

Columbia Radiator Co., McKeesport, Pa., appointed W. T. Leonard as its eastern sales manager. Mr. Leonard, until recently, was vice-president of the Handon Boiler Corporation.

Phillips Self-Drilling Expansion Shell

Economical and reliable for fastening equipment to concrete walls, ceilings, floors, beams and columns. It has internal U. S. Standard Threads for rods, bolts and screws.

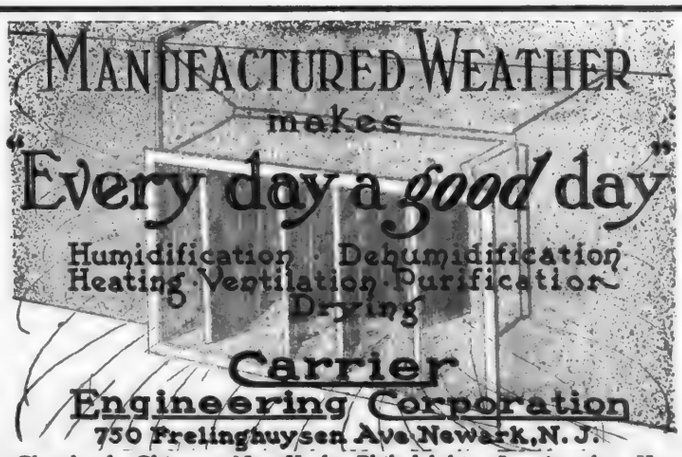
Quickly installed by hand. Every shell makes its own hole. No drills required.

PHILLIPS DRILL COMPANY
1537 Cortland Street Chicago, Ill.

Standard Heat Calculation Sheets

Here are the forms you have been looking for.
Size 9¼ inches by 11 inches.
Printed on bond paper with extra margin on one side for binding.
Price in lots of 100, $1.00.

Published by
Heating and Ventilating Magazine Co.
1123 Broadway, New York



SEE OUR DETAILED DATA IN A.S.H.&V.E. GUIDE

SEE OUR DETAILED DATA IN A.S.H.&V.E. GUIDE

Boston Cleveland Chicago New York Philadelphia Los Angeles Kansas City

The Boss: "....and you've got to get that system done on time. The delays on the Riverville job cost us money.

Old Timer: "Sandholes in the fittings were the cause of that cost. Specify Grinnell fittings on this job and we'll show you some real speed."

The Old Timer Knows

When you see the big "G" on a Cast Iron Fitting, you can know beforehand that it will make on quick, and snug, and *true*. And when the job is done, it's done for keeps, because there's not a lot of undiscovered sandholes to cause time-wasting replacements. Put Grinnell Fittings to the test on your next job. If your jobber hasn't stocked them we'll give you the name of the nearest distributor. Write Grinnell Company, Inc., 280 W. Exchange St., Providence, R. I.

GRINNELL
PIPE FITTINGS

Cast Iron Fittings—Adjustable Pipe Hangers

GRINNELL

Pipe Bends—Welded Headers—Lap Joints—Piping Supplies

Automatic Burner Corp., Chicago, recently sponsored a gathering of its eastern dealers at the Hotel Bossert, Brooklyn. The speakers included J. H. Hirsh, president; M. M. Hirsh, general sales manager; E. A. Weil, secretary; Oscar Schroeder, chief engineer; E. H. Haupt, advertising director; and Leod D. Becker, managing director, American Oil Burner Association.

Fitzgibbons Boiler Co., 570 Seventh Ave., New York, has opened a branch office at Room 442, Land Title Bldg., Philadelphia, Pa., which will be in charge of Walter R. Dome.

Rome Brass Radiator Corp., 1 East 42nd St., New York, announces the appointment of W. D. Jamieson as sales representative, with offices at 216 Tremont St., Boston. R. F. Gifford is associated with Mr. Jamieson.

Central Station Heating Notes

Rochester, N. Y.—Rochester Gas and Electric Corporation has applied for a permit to erect a central heating plant at Mount Read Boulevard, near the Buffalo Road. The plant will supply steam to consumers in the western part of the city, including industrial concerns in the Lincoln Park district. The plant is to be of steel and cinder block construction, with ground dimensions of 108 x 72 ft. The estimated cost is $110,000.

New Incorporations

Chicago Oil-Burner Association, Chicago, Ill., was incorporated May 10, by Lyle Straight, Williams Oil-O-Matic Heating Corporation; Russell D. Barnes, A. B. C. Oil Burner Sales Corporation; Cliff W. Presdee, THE HEATING AND VENTILATING MAGAZINE; Charles H. Crese, Aladdin Utilities Corporation; and D. M. Durkee, Rayfield Mfg. Company. At a meeting of the board of directors, following the incorporation, the form of membership certificates was determined for active and associate membership. Certificates will not be given affiliate members. The board authorized the publication of the association's constitution and by-laws, the membership list and the oil-burning ordinances of the Chicago district. Russell D. Barnes was elected vice-president of the association.

Grant Accessories Corp., 107 Liberty St., New York, has been formed to manufacture packless oil pumps and oil-burner equipment for use on all types of burners and designed to simplify mechanisms and service. The equipment includes strainers, automatic shut-off valves, motored packless oil pumps, both single for discharge under pressure, and twin, for maintaining a level, motored packless pumps with low-pressure blowers, and a similar type with pressure air compressors.

All motored units will be equipped with the Westinghouse refrigerator motor. By special arrangement with the Westinghouse Electric & Mfg. Company, samples of all units will be checked by its design engineers. Also sales and motor service co-operation will be extended throughout the Westinghouse branches.

Page & Hooker Co., Duluth, Minn., has been formed by S. H. Page and W. L. Hooker, with offices at 707 Torry Building, to conduct a consulting engineering business in mechanical and electrical equipment for commercial buildings and power and industrial plants.

Changes of Address

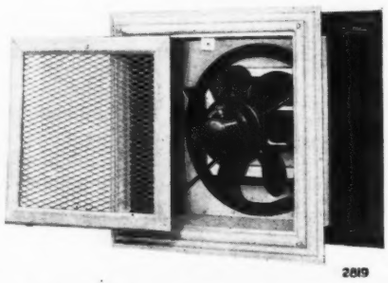
Kewanee Boiler Co., Inc., Kewanee, Ill., announces the removal of its Philadelphia sales offices to the Land Title Bldg., Broad and Chestnut Streets.

Barnes & Jones, Boston, Mass., manufacturers of the Barnes & Jones heating appliances, has moved its New York office from 300 Madison Avenue to 126 East 44th Street. The office is in charge of H. B. Eells and associated with him are Messrs. Sickenberger and Steinbrunn.

Industrial Appliance Company of New England, announces its removal of its offices to 250 Stuart St., Park Square, Boston, Mass.

Kennedy Valve Mfg. Co., Elmira, N. Y., has moved its Chicago office to the Soo Terminal, 1355 South Clinton Street.

For new and old homes! Emerson Exhauster with wall box



THIS newly designed wall box makes it easy to provide for the permanent installation of a 12-inch Emerson exhaust or ventilating fan in the kitchen or wherever needed.

Adjustable for walls 9½ inches and thicker. Complete with aluminum louver, ready to build into the wall. Puts the fan out of sight, out of the way.

New Emerson bulletins Nos. 3517-3518 give full data and dimensions of fans, 9 to 30 inches in size, and accessories. May we send them?

THE EMERSON ELECTRIC MFG. CO.

2018 Washington Ave., St. Louis, Mo.

806 W. Washington Blvd. Chicago, Ill.

50 Church St. New York City

3 big advantages:

1 suitable for wood or concrete floors

2 can be set after floor construction is completed

3 Easy to replace broken casting

the New Improved Bottom Casting of *Nu-Notch* REG. U.S. PAT. OFF.

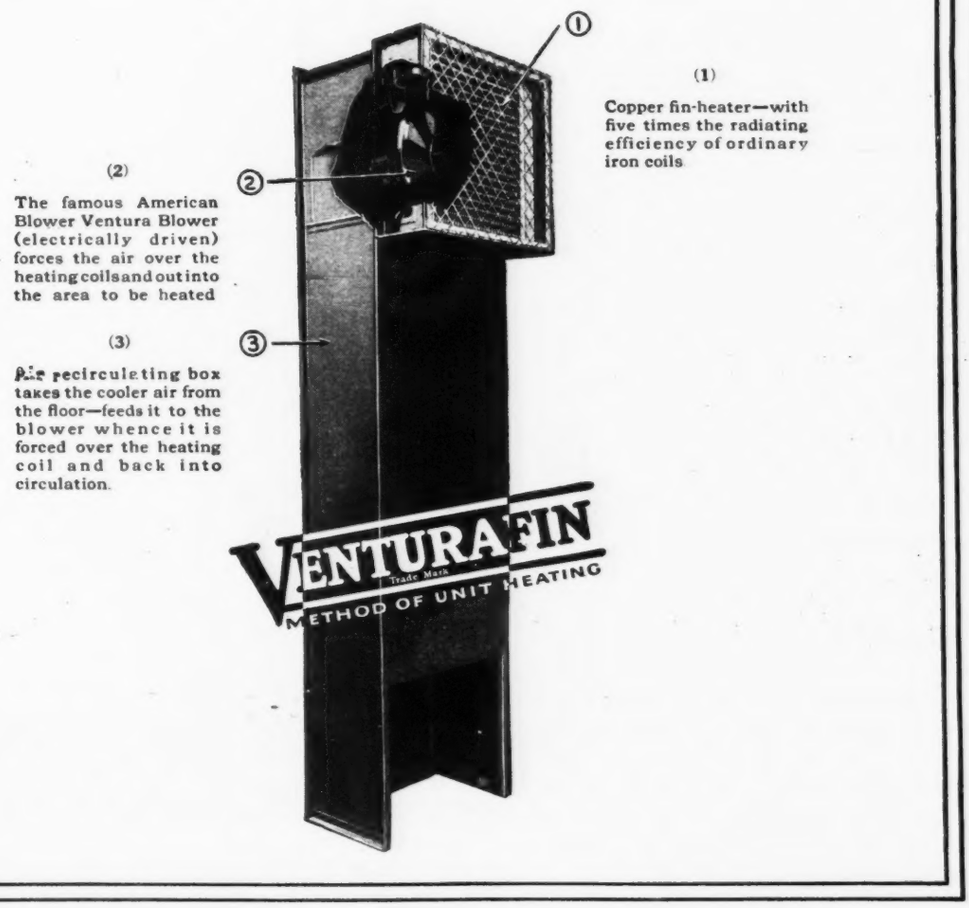
MUSHROOM VENTILATORS

Nu-Notch Mushroom Ventilators are conceded by architects and engineers to be most satisfactory. Note the advantages of the improved bottom casting. Special flat tops provided for use on the inclined floor section of orchestra.

KNOWLES MUSHROOM VENTILATOR CO.

202 Franklin Street · New York, N. Y.

HEAT WITH UNIT HEATERS


(1)
Copper fin-heater—with five times the radiating efficiency of ordinary iron coils
(2)
The famous American Blower Ventura Blower (electrically driven) forces the air over the heating coils and out into the area to be heated
(3)
Air recirculating box takes the cooler air from the floor—feeds it to the blower whence it is forced over the heating coil and back into circulation.
VENTURAFIN
Trade Mark
METHOD OF UNIT HEATING

FROM the heating engineer's standpoint, the Venturafin Method of Unit Heating offers important advantages not found in other types of heating equipment.

(639)

Dealers — write for selling plans. Heating Engineers—write for catalogs and technical data.

AMERICAN BLOWER CO., DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO CO., LTD., WINDSOR, ONTARIO

American Blower

"Sirocco" TRADE MARK

VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT

MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881

International Heater Co., Utica, N. Y., announces that its new Philadelphia address is 1613 Race Street. M. H. Smith, E. B. Wheeler and H. Bowie, heating engineers, will be in charge of the office.

SALESMEN WANTED.—Large boiler and radiator manufacturer requires services of high-grade and experienced salesmen for New England Branch territory. Address Box 76, care of Heating and Ventilating Magazine.

SALESMEN WANTED.—Experienced radiator and boiler salesmen for Brooklyn and Long Island. Please give previous experience in first letter. Union Radiator Co., Johnstown, Pa.

POSITION WANTED.—Young heating and ventilating engineer experienced in design, estimating and supervising vapor, gravity steam, water, mechanical and gravity warm-air systems, desires location with manufacturer or contractor. Available August first or later as desired. Address Box 72, care Heating and Ventilating Magazine.

POSITION WANTED.—Heating and ventilating engineer and executive of good personality desires connection with high grade business. 39 years of age. 23 years' experience in selling, engineering, estimating, superintending of all types of heating systems and buildings, also power, oil burning and ventilating work. Conducted own business for 6 years. Connected for 17 years with nationally known engineering and contracting concerns. Good acquaintance with architects and engineers. Location New York or vicinity. Address Box 73, care of Heating and Ventilating Magazine.

POSITION WANTED.—Heating and ventilating engineer, 27, experienced in design, installation, testing, layouts, excellent draftsman, technical graduate, seeks connection with architect, engineer or large contractor. At present employed. Good references. Address Box 74, care of Heating and Ventilating Magazine.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

MANUFACTURER'S REPRESENTATIVES WANTED.—Handling theatre selling or similar lines to handle our line of mushroom floor ventilators and riser grilles advertised elsewhere in this issue. Richmond Air Equipment Co., 908 E. Cary St., Richmond, Va.

SALES ENGINEERS WANTED.—Old established company, manufacturing high-grade vapor heating specialties, has some territories open at the present time. Write if you are interested in selling this line on a commission basis. State territory and other lines. All communications held strictly confidential. Address Box 77, care of Heating and Ventilating Magazine.

SALESMAN

familiar with steam specialty applications in manufacturing plants to solicit industrial business in northern New Jersey under New York sales office. Must be resident of New Jersey, under 30, with good character, references and education. For consideration state age, education, experience and salary expected. Car desirable. Address Box 75, care of Heating and Ventilating Magazine.

MANUFACTURER'S REPRESENTATIVE—Manufacturer of complete line of fans, air washers and unit heaters, desires recognized representatives on commission basis. Address Box 71, care of Heating and Ventilating Magazine.

SHOP OWNERS ATTENTION!

Here is something new in the way of service to you. We have added a new facility that you can take advantage of—our

PRIVATE CONSULTATION SERVICE

—for a period of one year.

Business administration, management, better methods, technical problems, many phases of your own shop and its greater success are covered in the advice given you individually.

Write us for further information on this splendid, new service to help put your business on its feet at very reasonable cost.

St. Louis Technical Institute,
4543 Clayton Ave.,
St. Louis, Mo.

TWINFAN Unit Heaters

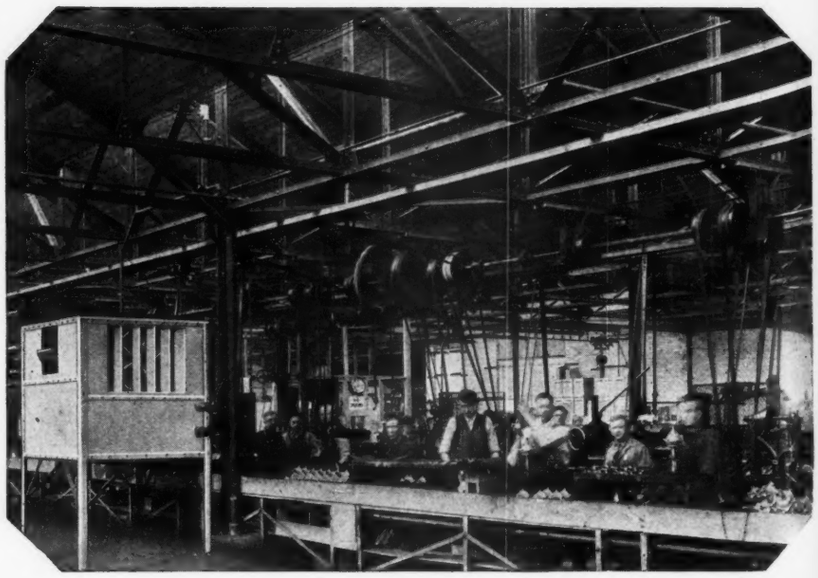
Economy *Plus* Comfort

IN winter, Dwyer TWINFAN Unit Heaters by their special indirect radiation system, keep the warmed air down to the level of the workers where it belongs, and away from the ceilings where it is wasted. That's why they effect tremendous savings in fuel.

In summer TWINFANS connected by ducts to the outside air furnish an adequate ventilating system that takes the discomfort out of hot, murky days.

And in fall and spring, TWINFANS make possible an immediate control of the heat by a turn of a switch. More than that, the heat may be turned on full in one part of a building and at the same time may be completely shut off from another part.

For a heating system that makes revolutionary reductions in heating costs, that saves floor space and provides a measure of comfort, that speeds up production and keeps workers contented, look up the records that are being made by TWINFANS in industrial plants and garages. Names and addresses on request.



You can build up a profitable REPEAT ORDER *business by selling TWINFANS to your customers. Our engineers will gladly help you on your next heating job.*

DWYER EQUIPMENT COMPANY
4534 W. NORTH AVE. CHICAGO, ILL.